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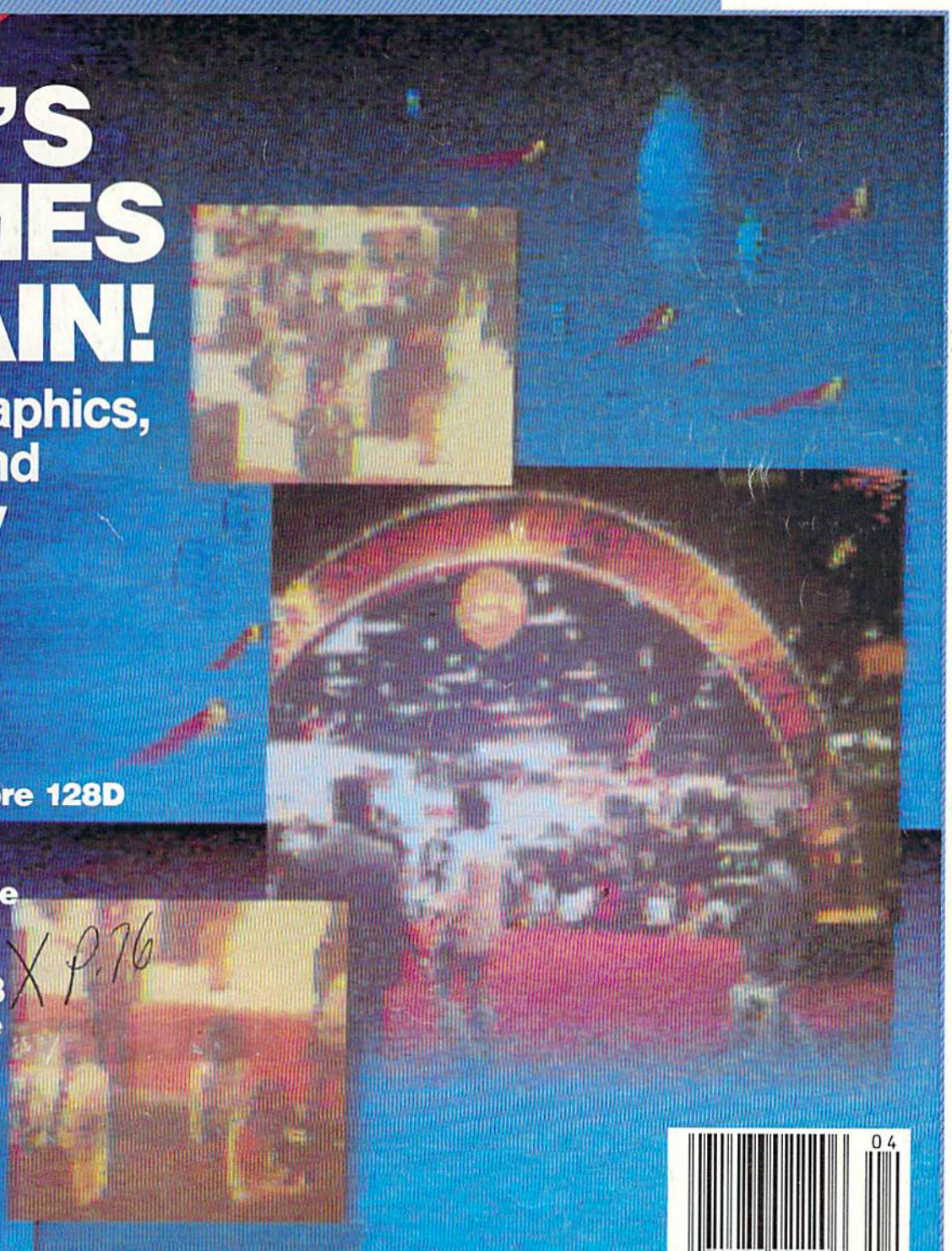
X p. 76



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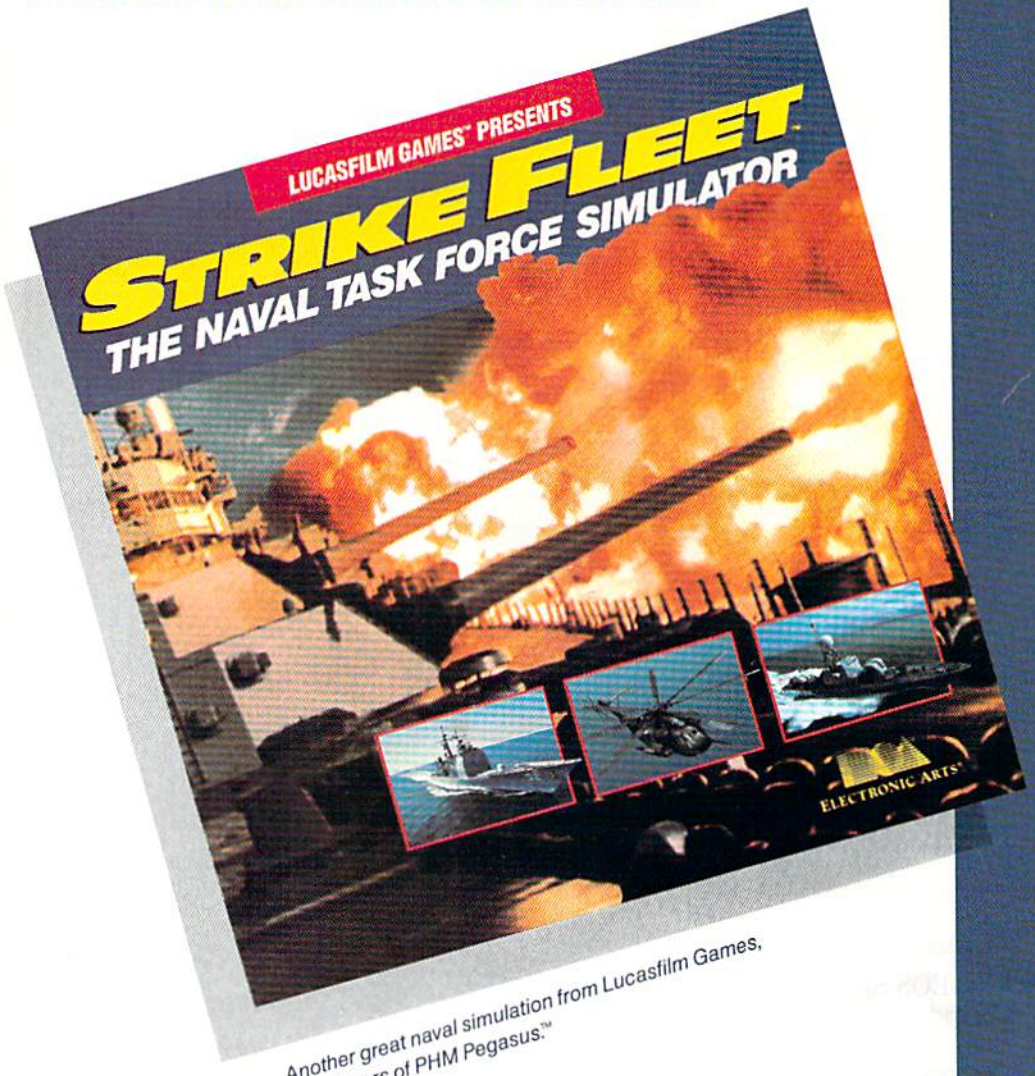

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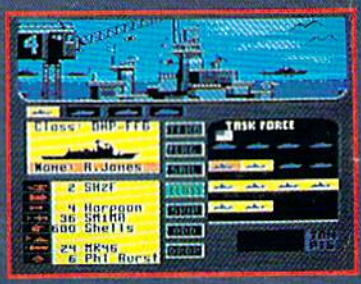

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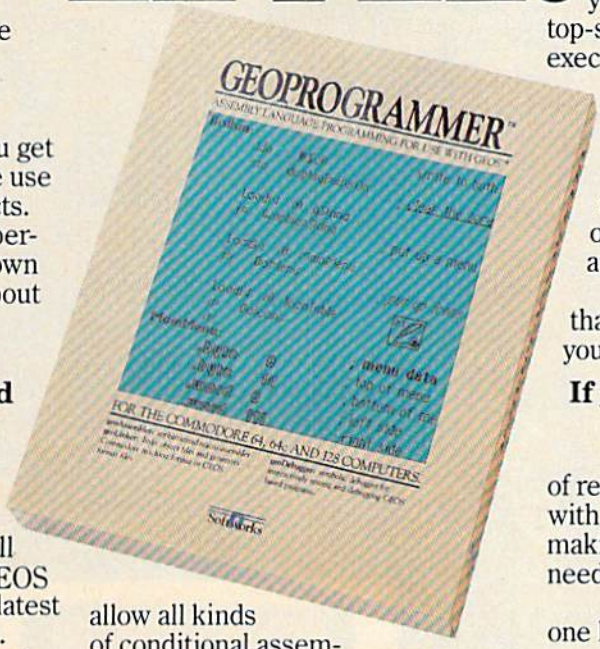
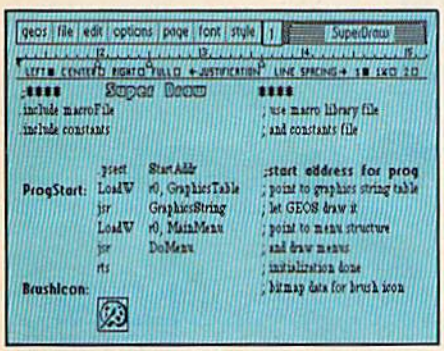
geoAssembler not only reads directly from geoWrite files, but contains enough Pseudo Ops to allow all kinds of conditional assemblies. It has all the state-of-the-art features you'd expect, including some you probably never thought possible. For example, integrating graphics is as simple as cutting and pasting the image from geoPaint directly into your program.



geoLinker ties your program modules together, supporting GEOS SEQ and VLIR applications and desk accessories. You can even use geoAssembler and geoLinker to create non-GEOS applications.



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geoDebugger allows your program to be tested in memory with full symbolic disassembly, along with line assembly for patching code in memory. It also allows your code to be single-stepped or top-stepped, with sub-routines fully executed. It can stop a running program with one key, or use up to eight conditional breakpoints. When your program hits the breakpoint, it prominently displays the error in an overlay window, leaving the applications screen intact.

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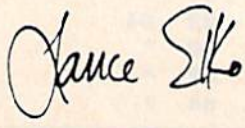
editor's notes

Our special thanks to those readers who responded to the "GAZETTE Readership Survey" in the December issue. This feedback, along with our regular reader mail, is very valuable to us. We get to know you better, and we gain a keener insight into what kind of Commodore user reads the GAZETTE and for what reasons.

While time constraints prevent us from answering all of our reader mail, we respond to selected questions in the "Reader's Feedback" column. Feedback's focus, by tradition, is mainly on programming and technical questions. Until this issue, we have not had a forum for more general reader comments. On page 6, you'll find our first "Letters To The Editor" column.

Another "first" for us is also in this issue. On pages 54–55 is the debut announcement of the *GEOS* Programming Contest, sponsored by Berkeley Softworks and the GAZETTE. The contest offers more than $25,000 in cash and prizes, across 24 categories. Prizes include *GEOS* packages from Berkeley Softworks, Commodore peripherals, subscriptions to the GAZETTE and QuantumLink, and more. If you're a *GEOS* programmer, be sure to read the contest details. And start programming—the deadline is August 31.

Also in this issue is our biannual CES report (page 8). Our Features Editor, Keith Ferrell, went to the winter show in Las Vegas and has a lively story on the latest in 64 entertainment software, some of the best games to date.



Lance Elko
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COMPUTE!'s GAZETTE

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letters to the editor

This month, we're happy to introduce a new column. "Letters to the Editor" will be a regular feature with a different slant from "Gazette Feedback." The latter will deal more with programming and technical questions, while this column will provide a more general forum for reader comments.

More 128 Software

I feel that the Commodore 128 has been neglected by game software companies. I hope you will print this letter so that other Commodore 128 users will read this and ask major software companies like Epyx, Brøderbund, Data East, Mindscape, and others to release high-quality software for the 128.

Matt Getman
Ballston Spa, NY

A Good December

Congratulations! Your December 1987 issue is the finest, going back to July 1983.

Brian P. Vaughan
Alameda, CA

"Disk Rapid Transit" (December 1987) is fantastic, and I now have duplicates of all my GAZETTE Disks. Thank you, and keep up the excellent work.

George J. Clark
Pointe Claire, Quebec

The Debate Continues

I read with special interest the debate between Larry Cotton and Todd Heimarck concerning structured vs. unstructured programming (January 1988). I cut my teeth on a VIC-20, and I learned to write crunched programs as a necessity. I became so accustomed to this that I cannot bring myself to structure my programs—it seems so inelegant and wasteful. Admittedly, crunched programs are more difficult to debug, and the character density is bewildering at first. But I contend that there is an art to program crunching that can make the overall nature of a program *easier* to follow. Crunched, there is a sense of architecture in the way the ideas are grouped, and the program flow arguably can be said to be enhanced.

Regarding highly structured programming as the conventional wisdom is not necessarily correct thinking. If my programs don't earn Mr. Heimarck's "A+," I just don't care. Structuring or unstructuring counts for nought. What really counts is *efficiently* obtaining the goal of the program.

Paul W. Graham
Independence, MO

It is with considerable amusement that I read the discussion in the January 1988 issue regarding structured vs. unstructured programming. You can argue all you want—the real question is: Does the program do the job for which it was designed, and can the user easily operate it? If the answer is *yes*, then the program is a good one.

E. Stuart Johnson
Athens, AL

After reading your debate on structured/unstructured programming, here's another opinion. As a software systems analyst, I've worked with both kinds of programs. Structured programming is widely accepted as standard. The problem with unstructured programming is that the programmer must comprehend the entire program at all times. This may work fine for small programs, but when they become large, they are very difficult to work with. To modify an unstructured program, you must read and understand the entire program before knowing how to change it.

I like to draw analogies to structured programming. When NASA worked on the Mercury program, its style was more unstructured. At times it took weeks to replace faulty components. NASA learned from this approach when building Gemini capsules. Components were modularized and easily tested and repaired. Had they not gone to a more structured approach, we could never have reached the moon by 1969, let alone get the space shuttle off the ground.

The more complex the system, the more the need for structure. Regardless of the language you use to program, you should break the problem down into small comprehensible modules and use these as building blocks for higher functions. Take time to learn structured programming now, and it will save you time in the long run.

Forrest Bentley
Minneapolis, MN

Forrest Bentley is the author of "Sketch Pad," a hi-res drawing program featured in the November issue.

Call For VIC-20s

I need your help to publicize a program in which we are collecting VIC-20 computers that are being distributed to promising junior and senior high students who live in Apache, Hopi, and Navajo Indian reservations in northern Arizona. Selection of students and distribution is being made by staff members of Northern Arizona University. If you have readers who are interested, please tell them to send a VIC and/or accessories. I'll ensure that each old VIC will brighten the eyes of a native American student. Please tape a card with your name and address to the bottom of the computer; then I can let you know whose eyes your donation brightens. Thank you.

Readers interested in donating to this program can send VIC-20s and/or accessories to:

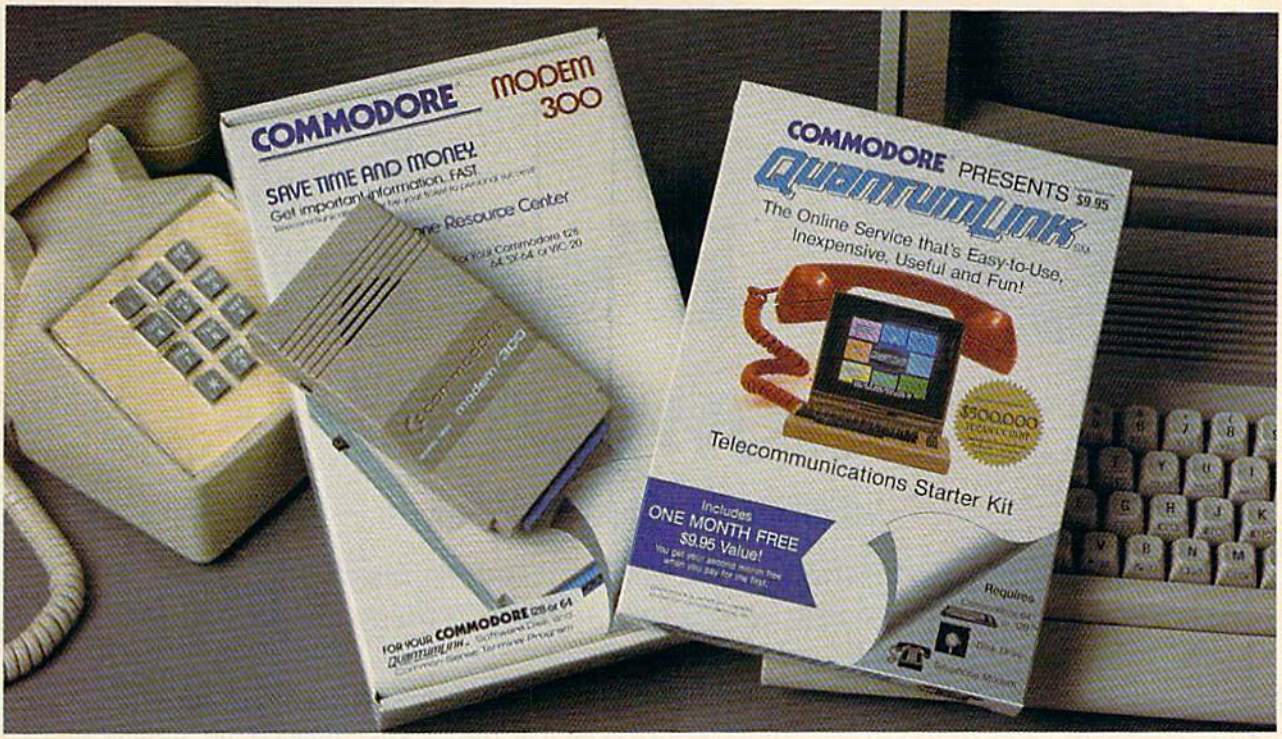
Joseph Hobart
975 Mesa Trail
Flagstaff, AZ 86001

We talked with Mr. Hobart, and believe that this is, indeed, a worthy effort. We're sending along our five VICs with accessories from the offices here at COMPUTE!.

Tape It

I type in many program listings from magazines. The checksums and entry programs are great, but they can't prevent you from losing your place in a listing. Once in a while, you might be able to bribe a friend to read the listing while you type, but don't count on it. My solution is simple: Use a tape recorder. Read the data statements or hex code slowly into the tape recorder. Play it back while you type it in. (If you get behind, you can always stop the tape.) To check the listing, play the tape again and check the screen. It works for me.

David Kapsos
Portsmouth, NH



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Report From The 1988 Winter Consumer Electronics Show

Keith Ferrell, Features Editor

Despite the revitalized video-game market, software publishers brought impressive new games for the 64 into the spotlight at CES.

Once again, the 64s and 128s on display at the Winter Consumer Electronics Show (CES) belonged to software developers introducing new Commodore products.

Commodore chose to bypass the Las Vegas show this past January, concentrating its efforts twice a year on COMDEX (the trade-oriented Computer Dealer's Exposition) as well as on various Commodore-only shows.

The company's presence was missed. Many software publishers noted that the 64 and 128 have always been seen as consumer products, pointing out, as well, the opportunity afforded by CES for Commodore to mount a counter-offensive into Nintendo and Sega country.

Year Of The Cartridge—Or Is It?

In many ways the computer section of CES *was* Nintendo and Sega territory. Nintendo's booth alone occupied a major portion of the floor space, its racks adorned with dozens of game packages, and more than a few of them translations of established computer entertainment packages. It seems 1988 will be remembered for many things, and one of them is the dramatic comeback made by dedicated videogame machines. Nintendo, Sega, and Atari are all showing strong sales, attracting many customers who might otherwise choose to buy a 64 or 128.

Fortunately, there were plenty of developers showing a strong commitment to the 64 and 128 market, demonstrating entertainment programs that once more stretch the capabilities of those machines. For Commodore 64 and 128 owners, the big news from CES was the depth and quantity of new games that will be available this spring.

"Games can be done better on the 64 than on a Nintendo," said Epyx president David Morse. The additional advantage offered by the 64 or 128, of course, is the fact that they are fully functional computers. When a user tires of game play, his Commodore machine can open whole other worlds of productivity and entertainment that are simply unavailable on a dedicated gaming machine. This is a point that Commodore stressed in a series of after-school and Saturday morning TV commercials during the pre-Christmas season, and a point that many wished the company had made on the CES floor.

Software On Parade

The products on display at CES made it clear that software publishers weren't going to let Nintendo and Sega conquer the gaming market without a fight. There were more solid arcade games on display in Las Vegas than at any CES in recent memory. Activision, Epyx, Mindscape, Accolade, Brøderbund, Cinemaware, Data East, and others were on hand with colorful games or with games that incorporated arcade action set against venues that ranged from races through urban streets to dueling monsters, to interstellar combat to do-it-yourself arcade construction packages.

Topicality also showed up as a theme in entertainment software. Terrorists, superpower tensions, the place of military might in the modern world—all served as foundations for new games. (Two of Tom Clancy's cold-war thrillers—*Red Storm Rising* and *The Hunt for Red October*—were present in Commodore adaptations.) When a consumer tires of reading about naval presence in the Persian Gulf, there are half-a-dozen software programs available to duplicate the situation.

There were whole new software forms as well. Infocom debuted its Infocomics line, which consisted

of cinematic comic books on disk. Cinemaware continued to merge software with motion picture techniques. Electronic Arts revealed a modem game that permits players to test their skills against gamers on IBM or Apple systems. Across the board, entertainment developers displayed games and programs packed with sharper graphics, more dramatic sounds, smoother animation, and deeper levels of play than ever before.

Additionally, many software publishers are beating the game cartridge manufacturers at their own game, licensing rights to software products for release as cartridges or coin-operated games.

Mature Productivity

There were fewer productivity tools on display than at previous shows, and that can be traced to a sense that the Commodore market is well-served by products already established. Still, some new productivity areas loom as windows of development opportunity. One of those areas is the emerging desktop video market, which Epyx is entering, and for which Datasoft is consolidating two existing packages.

Berkeley Softworks boasted one of the largest floor exhibits, its full line of Commodore productivity packages on display, and *geoProgrammer* was up and running, along with the company's growing line of 128-specific products. Berkeley, indeed, has found sufficient success in the Commodore market to take it's show on the road: *GEOS* applications are now ready for entry into the Apple market.

But it was entertainment that the Commodore developers at CES seemed most interested in promoting. In the face of a hot, aggressive cartridge game market, software developers are sending a clear message: The 64 and the 128 are superior game machines, and they are here to stay.

Here's a look at some of the new products announced at the Winter Consumer Electronics Show, listed alphabetically by company.

Accolade

In *The Train*, suggested by a movie of the same name, players must hijack a Nazi train filled with art treasures, maneuver it through enemy lines, and reach the coast of Normandy. Seizing the train and breaking through enemy positions calls on arcade-like shooting skills, while running the locomotive involves mastering an accurate simulation of engine controls. To be released shortly, *The Train*'s suggested retail price is $29.95.

Power at Sea puts players in charge of a U.S. convoy in the midst of the Battle of Leyte Gulf. At your disposal are an aircraft carrier, a battleship, and a troop transport. It's up to you to choose the proper combination of forces to secure your objectives. *Power at Sea* is priced at $29.95.

Play poker with Ronald Reagan, Mikhail Gorbachev, and Margaret Thatcher in *Card Sharks*, or enjoy a fast game of Hearts with some of the other characters included in the game. The package includes three flavors of poker, as well as Blackjack and Hearts; released after CES, *Card Sharks* is priced at $29.95.

Accolade, 20813 Stevens Creek Blvd., Cupertino, CA 95014

Activision

Rampage, one of the hottest new arcade games, comes to the 64 in March. Players control Godzilla, King Kong, or the Wolf Man on a destructive romp across the country. The monsters must maintain their strength and energy, or they'll shrink to a defeatable size. *Rampage*'s price is $34.95.

Star Rank Boxing II

Players are invited to retreat to neutral corners, and then come out swinging in *Star Rank Boxing II* ($29.95), an addition to Activision's Gamestar line. *Star Rank Boxing II* challenges players not only to perform well in the ring, but also to set their fighters a sound training and workout routine in preparation for a fight.

Activision, 2350 Bayshore Pkwy., Mountain View, CA 94043

Brøderbund

She's at it again. Carmen Sandiego is on the loose and it's up to you to track her down. *Where in Europe is Carmen Sandiego?* is the latest in Brøderbund's popular series. This time, players must track Carmen across Europe, gathering clues and using new features such as a Crimestopper's notebook, an onscreen map of Europe, and an online database filled with European information. The game carries a suggested retail price of $39.95.

Arcade fans can build their own games with *Arcade Construction Kit*, available at $29.95. The package includes seven complete games, whose elements can be cannibalized and used in other games, as well as providing tools by which players can build their own arcade games, setting different levels of animation, sound, and design.

Brøderbund, 17 Paul Dr., San Rafael, CA 94903-2101

Cinemaware

"Calling Dr. Howard, Dr. Fine, Dr. Howard!" In other words, calling the Three Stooges. That's what Cinemaware has done with its new package, *The Three Stooges*, an interactive movie in which the player maneuvers Larry, Moe, and Curly through a series of (mis)adventures as they try to save an orphanage from foreclosure. The program recreates some of the Stooges' classic routines and is priced at $34.95.

Remember Commando Cody? So does Cinemaware, paying tribute to the World War II hero in *Rocket Ranger*. The fate of the allied world depends upon your skill—with your rocket suit, your wits, and your fists—as you battle time-travelling Nazis, cliff-hanger chapter endings, strategy and arcade elements, and Zombie Women of the Moon. The game is set for spring release and is priced at $34.95.

Cinemaware broadens its line with its first hardware release, the Warpspeed cartridge. Warpspeed boosts loading, verifying, and formatting speeds; offers a variety of disk and file utilities; includes a multifeatured machine language monitor and a built-in sector editor. The cartridge is set for spring release and will be priced at $49.95.
Cinemaware, 4165 Thousand Oaks Blvd., Westlake Village, CA 91362

Cosmi

The title says it all in *The President is Missing!*. The package, retailing at $24.95, includes an audio tape containing the terrorist's demands and clues that might help you track down the kidnapped chief executive. Cosmi promises, though, that all is not as it may seem: Be alert for plots and subterfuge beneath the surface of this game.

NAVCOM 6: The Gulf Defense places players in the control center of a modern warship charged with protecting oil tankers negotiating the straits of Hormuz. At your disposal are all of the elements that make up an actual defensive convoy; arrayed against you are the Ayatollah's missiles, mines, and madness. The game is priced at $24.95.
Cosmi, 431 N. Figueroa St, Wilmington, CA 90744

Covox

Can we talk? That was the message at Covox, which introduced *Voice Master Junior*, a $39.95 digital-speech package that includes disks and a voice master module that plugs into the joystick port. The program permits digital speech playback and editing.
Covox, 675-D Conger St., Eugene, OR 97402

Data East

Delivering coin arcade games to Commodore owners is high on Data East's list of priorities, as the company rolled out several translations at CES. *Ikari Warriors*, $29.95, brings the game gallery commandos to home machines (its sequel, *Victory Road* will be released in early 1988); *Speed Buggy*, $29.95, offers high horsepower thrills and chills; *Kid Niki*, $29.95, is a true-to-arcade-game ninja adventure; and *Karnov*, $29.95, puts players in the position of a Russian warrior, fighting through different levels in search of the treasure of Babylon.
Data East, 470 Needles Dr., San Jose, CA 95112

Datasoft

Tom Clancy's first best seller becomes a software game with Datasoft's January release of *The Hunt for Red October*. In this simulation, players assume the role of Soviet submarine commander Marko Ramius and attempt to defect to the U.S., taking your submarine—the Red October—with you. The game carries a suggested retail price of $39.95.

The Hunt For Red October

In *BattleDroidz*, players combine strategy and action in an attempt to conquer alien enemies. The game offers 37 different landscapes and a choice of BattleDroid. Set for February release, *BattleDroidz* will be priced at $24.95.

The Rubicon Alliance, available at $29.95, challenges players to face an implacable, invading alien enemy. Players must pilot a starcraft against the invaders, not only destroying them, but also gathering information that leads to their home planet.

Carry the weight of the world on your shoulders in *Global Commander*, available at $29.95, in which you must monitor the status of 16 separate nations. It's up to you to allocate food, raw materials, and weapons without upsetting the balance that keeps the world running peacefully.

The company also announced that its desktop video products, *Video Title Shop* and *Graphics Companion I*, will be released as a single package, priced at $29.95.
Datasoft, 19808 Nordhoff Pl., Chatsworth, CA 91311

Electronic Arts

Dan Bunten's Sport of War is a modem strategy that allows players to pit their skills against other gamers, including those playing on Apple IIs or IBM machines. The April release also allows the player to go one-on-one against the computer. In the player's arsenal are cannon, cavalry, infantry, and spy units. *Sport of War* is priced at $34.95.

Topical tensions come to the fore in *Strike Fleet*, a new release from Lucasfilm Games, distributed by Electronic Arts. Players take command of task forces of various sizes, and are responsible for giving orders to crews of ships, weapons systems, and helicopters. Emphasis was placed upon accuracy of detail, with armaments including Phalanx antimissile systems and opponents including the Soviet Navy and Ayatollah-inspired fanatics.
Electronic Arts, 1820 Gateway Dr., San Mateo, CA 94404

Epyx

Making perhaps the strongest show of commitment for the 64 at CES, Epyx announced nine new products ranging from arcade action to combat simulation to sophisticated sports games.

With *The Games—Winter Edition*, Epyx extends its popular Games series. The new package is set in the mountains above Calgary

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Mad Max on Wheels.
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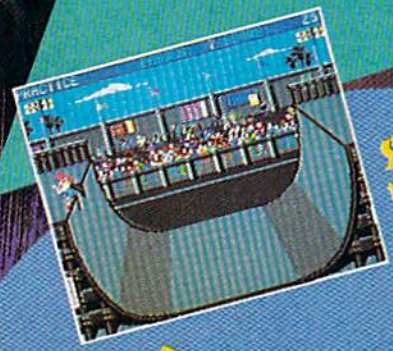

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Software by
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The Games—Winter Edition

Impossible Mission II

Dive Bomber

Street Cat

and includes competition events such as Oval-track Speed Skating, Luge, Slalom, Downhill Skiing, and others. Set for release in the first half of 1988, *The Games—Winter Edition* is priced at $39.95.

Epyx's "Masters Collection" line gets another addition with *L.A. Crackdown*, in which players attempt to crack a major drug smuggling ring. *L.A. Crackdown* will be released in March and will sell for $39.95.

The company's Street Sports line continues to grow, with the spring release of *Street Sports Soccer*. Priced at $39.95, the new entry continues the series' urban playground motif, with players selected from neighborhood kids, and games taking place in city parks or on streets.

Endorsed by the venerable journal *The Sporting News*, *Sporting News Baseball* lets players assemble teams whose performance is affected by their statistical history. The game offers multiple screens, sound effects, and full team selection. *Sporting News Baseball* is planned for release in the first half of 1988 at a suggested retail price of $39.95.

Elvin, the mastermind of *Impossible Mission* returns to the scene in the appropriately named *Impossible Mission II*. Targeted for release in the first half of the year at $39.95, *Impossible Mission II* challenges players to collect code numbers scattered throughout the villain's supposedly impenetrable fortress.

Sedate drives through the countryside are nothing like the ride Epyx has designed in *4 × 4 Offroad Racing*. This first quarter release lets you configure your vehicle, equipping it with material and supplies aimed at helping you survive rugged terrain. The game will be priced at $39.95.

MAXX-OUT, Epyx's new low-price series, gets a new addition this spring with *Death Sword*, developed by England's Palace Software, the group responsible for last year's *Rad Warrior*. Palace director Peter Stone describes *Death Sword* as an animated fantasy contest in which players must use their sword skills in an attempt to win freedom for a captive princess. *Death Sword* is set for spring release and will carry a $24.95 price.

At CES, Epyx announced its agreement to serve as exclusive U.S. distributor for England's U.S. Gold software products. The distribution arrangement will be launched in the first half of 1988 with three titles.

Dive Bomber challenges players to fly a carrier-launched torpedo bomber against a variety of German aircraft, mine fields, and ships, including the *Bismarck*. It will cost $39.95.

Street Cat, at $24.95, puts players in a feline role, competing in urban olympics against other cat competitors. Obstacles are fashioned out of familiar playground and street equipment.

Metrocross, also $24.95, is pure arcade action set against an obstacle-filled backdrop. Players must race the clock through 24 levels of increasing difficulty.

At CES Epyx also announced its entry into the desktop video market with *Home Video Producer*, which is scheduled for March release. The program lets camcorder owners add graphics, text, and special effects to their home video productions. Suggested retail is $49.95. *Epyx, 600 Galveston Dr., Redwood City, CA 94063*

Infocom

The masters of the interactive text adventure take an innovative tack with the introduction, in concert with Tom Snyder Productions, of Infocomics. This new software line draws its inspiration from a classic entertainment medium: the comic book.

Infocomics are not games. Rather, they are complete comic books on disk. Using line vector graphics, the programs employ cinematic techniques such as pans,

Zorkquest: Assault on Egreth Castle

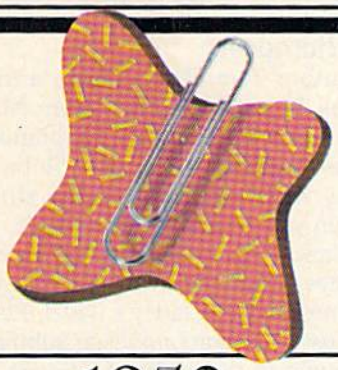
wipes, and zooms to communicate narrative motion and sweep. With a simple keyboard command, users may view scenes from various perspectives, shifting, for example, from the hero's point of view to that of the villain.

The first three titles in the series are *Lane Mastodon vs. the Blubbermen*, a spoof of 1930's science fiction; *Gamma Force in Pit of a Thousand Screams*, a superhero action/adventure; and *Zorkquest: Assault on Egreth Castle*, a fantasy.

T·H·E EVOLUTION OF THE PAPER CLIP

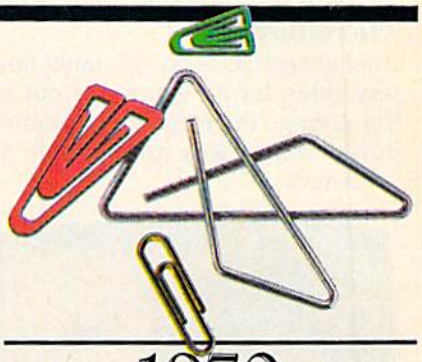
1900

Norwegian inventor, Johann Waaler, patents the paper clip in Germany. The metallic device allows one to attach sheets of paper together.



1950

By virtue of its sheer, simple power, Waaler's paper clip endures to become an indispensable item for both the home and office.



1970

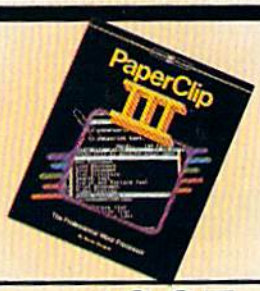
While computers diminish paper flow, new-fangled variations of Waaler's paper clip emerge in an array of sizes, shapes and colors. Evolutionary note: When man can no longer invent, he must improve.

1982

Batteries Included invents a powerful word processing program for Commodore® users—PaperClip®. Compatible with virtually every popular printer, PaperClip provides users with fast, flexible editing and formatting freedom.

1986

PaperClip II becomes the #1 best selling C128® word processing program. Added editing and formatting features include word-wrap and an 80-column screen mode. Built-in telecommunications and a spelling checker make the second generation a supreme package. Omni Magazine calls PaperClip II "the Cadillac of word processors."



1987

Once again, Batteries Included outdoes itself—and the competition. Presenting more formatting commands than ever before, PaperClip III lets users select multiple line headers/footers, as well as outline formats. Pop-up menus provide easier access to a host of improved functions and printing options. The best keeps getting better . . .

1988

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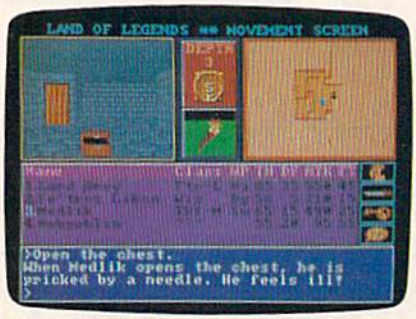
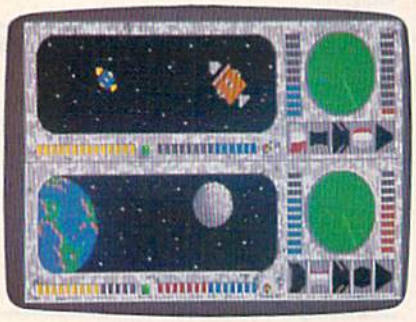
Infocom, 125 Cambridge Park Dr., Cambridge, MA 02140

Microillusions

Land of Legends is an animated fantasy role-playing game due out in the spring. Price for the Commodore version was unavailable at press time.



Land of Legends



Galactic Invasion

Ebonstar takes players into deep space where they search for rogue black holes. Available in the spring, the game offers more than 50 levels of play and is priced at $39.95.

Cosmic conquest is the theme of *Galactic Invasion*, to be released in the spring at $24.95. Players must invade enemy galaxy, collecting materials needed for the construction of the ultimate doomsday device.

A less combative approach to the universe is available in *Planetarium*, slated for spring release at $69.95. The program provides users with views of the sky from anywhere on earth, and its catalog of more than 9000 stars can be updated as new information is discovered.

Moving from the Amiga to the 64 are Microillusion's *The Faery Tale Adventure* ($49.95); *Fire Power* ($24.95), a tank game; *Black Jack Academy* ($39.95); and *Romantic Encounters at the Dome* ($39.95), an adults-only text game.
Microillusions, 17408 Chatsworth St., Granada Hills, CA. 91344

Microprose

Author Tom Clancy made a trip to Las Vegas for CES, where Microprose announced its adaptation of his huge best seller, *Red Storm Rising*. Coming in April, the simulation was written by Sid Meier, with Clancy's participation, and incorporates narrative as well as strategic elements from Clancy's novel. Players must command a nuclear submarine caught in the midst of a Soviet plan for conquest of NATO. *Red Storm Rising* will be priced at $39.95.
MicroProse, 120 Lakefront Dr., Hunt Valley, MD 21030

Red Storm Rising

Mindscape

Keyboard Peles will be able to take to the field with *Superstar Soccer*. The game, priced at $34.95, gives players the chance to function as manager, player, and coach. There's also a training camp for honing the edge of soccer skills.

Also on display at CES was an as yet untitled high-speed arcade game that reinvents the classic "Breakout" approach to software action. The game is scheduled for spring release.
Mindscape, 3444 Dundee Rd, Northbrook, IL 60062

SSG

Decisive Battles of the American Civil War, Volume 1 marks the debut of SSG's new simulations system. The first package includes the battles of First and Second Bull Run, Shiloh, Antietam, Fredericksburg, and Chancellorsville. The game includes tools for customizing battles and offers a variety of control options during the simulations. The game is set for release early in 1988 for $39.95.
SSG products are distributed by Electronic Arts

SSI

"Listen my children and you shall hear. . . ." SSI has brought three Revolutionary War battles to the Commodore. Bunker Hill, Saratoga, and Monmouth are available in *Sons of Liberty*, a strategic simulation. The battles may be fought under three levels of rules, and a solitaire option allows the computer to play both the Colonial and the English sides. The package is priced at $34.95.

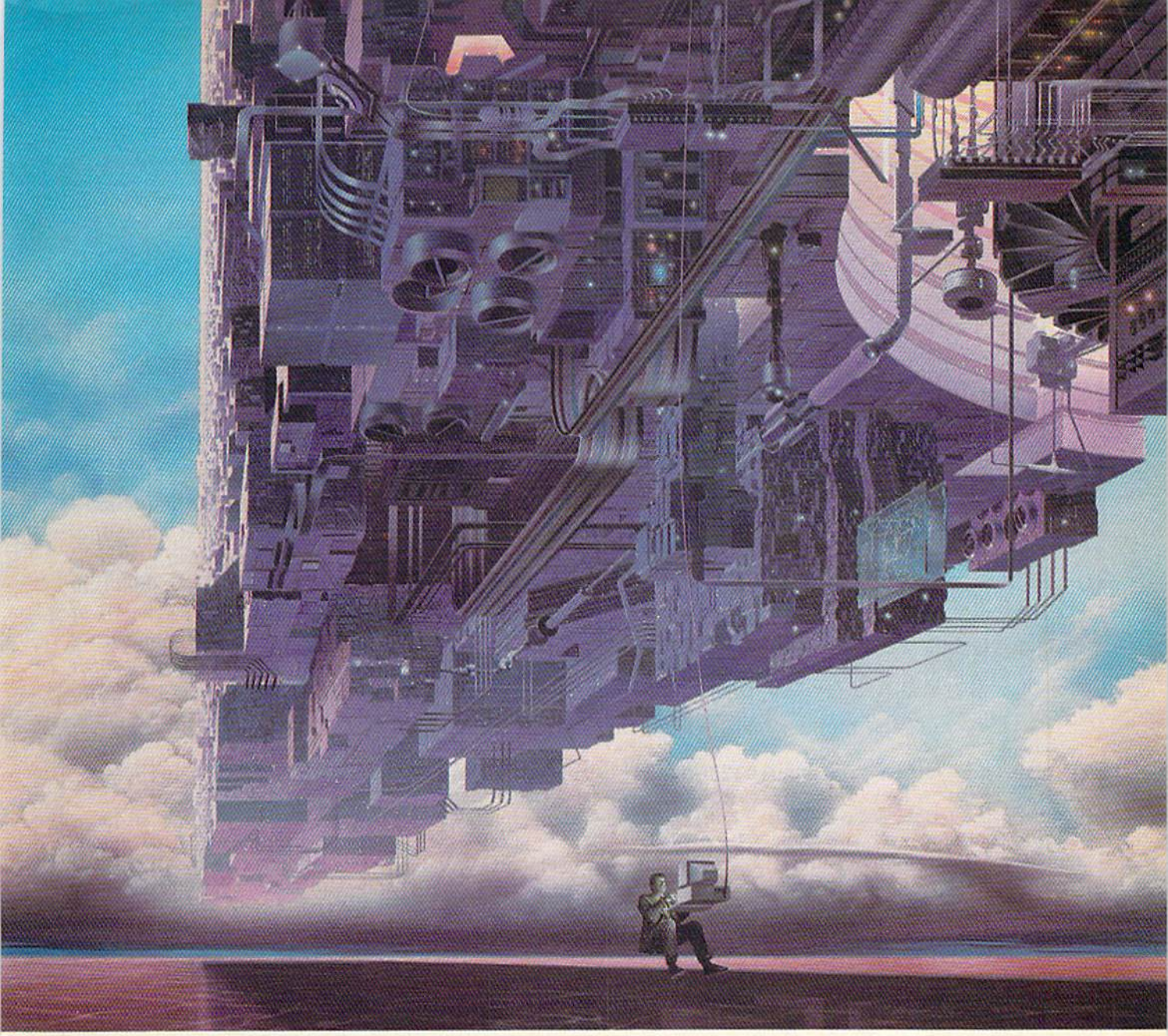
Warfare of a more modern sort is the subject of *Panzer Strike!*, a World War II simulation that includes most of the ground weapons employed during the Eastern Front campaign, the Western Front in 1940, and the struggle for North Africa. *Panzer Strike!* is priced at $39.95.

Questron II is a sequel to the popular fantasy in which players mounted a quest for the Evil Book of Magic. This time players, having discovered just how evil the Evil Book really is, must steer their quest back in time and endeavor to prevent the Book from ever coming into existence. A countryside must be explored, creatures encountered, and battles fought in this adventure, set for early 1988 release, priced at $39.95.
SSI, 1046 N. Rengstorff Ave., Mountain View, CA 94043

Thunder Mountain

This division of Mindscape announced a new package price, $14.95, with seven new products, including *Winter Challenge*, a sports game; *Tau Ceti: The Lost Space Colony*, a science fiction game; *Implosion* and *Wizball*, action games; *Head Over Heels*, a graphic adventure; and *Tai Pan*, based on the James Clavell novel.

At $9.95, Thunder Mountain announced *Murder by the Dozen*, a mystery game for up to three players; *Railroad Works*, in which players create a train system; as well as *Felony, Army Moves*, and *Doc the Destroyer*.
Thunder Mountain is a division of Mindscape.



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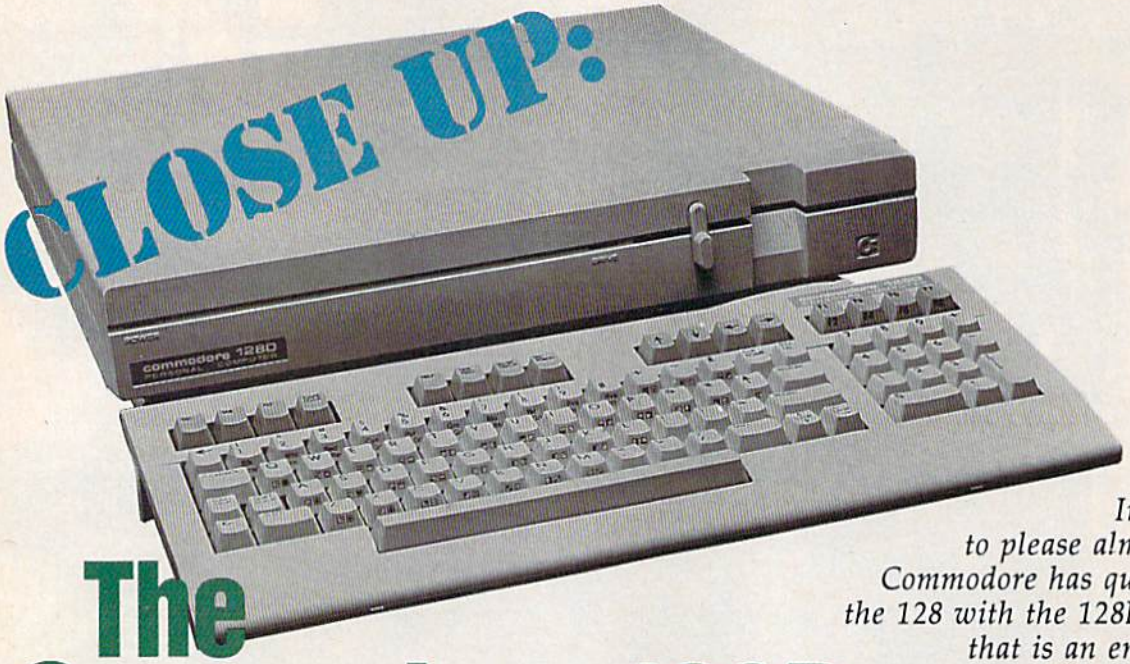

CLOSE UP:

The Commodore 128D

In a move sure to please almost everyone, Commodore has quietly replaced the 128 with the 128D—a machine that is an enhancement of the 128 while remaining completely compatible with the previous model's existing software and peripherals.

Clifton Karnes, Assistant Editor

The first thing you'll notice about the 128D is its new look. The computer's improved external design boasts a detachable keyboard and a slim metal case that houses the system hardware, the power supply, and a 1571 disk drive. The whole ensemble has a reserved, professional look, but there are some important practical advantages to Commodore's new design, too.

The 128D's detachable keyboard is identical in layout to the 128's, but it is more responsive and has a lighter action for high-speed touch typing.

The metal case has benefits, too. It protects the hardware from the outside world and provides an excellent RF shield. It also serves as a handy monitor stand, making a 128D system take much less desk space than an equivalent 128 system with a 1571 and monitor.

Biggest Improvement: Video RAM

Although the external design of the 128D is significant in itself, the 128D's enhancements don't stop there. The biggest improvement is in 80-column video memory. The 128's 8563 chip has 16K of dedicated video RAM available, but the 128D has an expansive 64K. With this extra RAM, spectacular 640 × 200, high-resolution graphics can be created.

Another improvement is found in the 128D's internal 1571. It comes with Commodore's new upgrade ROMs, correcting some bugs in earlier versions. And the 128D sports an enhanced version of CP/M 3.0 that fully supports Commodore's new 1581 drive and includes many enhancements not available in that operating system's early releases.

Compatibility

Functionally, the 128D works just like the 128. It has three modes—64 mode, 128 mode, and CP/M mode—and it runs both *GEOS* and *GEOS128* operating systems. All the 128's ports are represented on the 128D, though because of the new design, some are located in different places. Included are two ports for joysticks or a mouse, a serial port for disk drives and printers, a port for RAM expansion modules, a cassette port, and a user port for a modem or RS-232 interface. The 128D also has one of the 128's nicest features: a reset switch.

We've used the 128D with a wide selection of software and peripherals—including the new 1581 3½-inch disk drive—and all have performed flawlessly in 64 mode, 128 mode, with the new CP/M 3.0, and with *GEOS* and *GEOS128*. (It should be noted, however, that *GEOS* for the 64 does not yet support the new 1581.)

Are there any negatives with the 128D? Not many, and the few that there are center around the internal drive. Having the drive integrated with the system has benefits, but it also has a few drawbacks.

Since the 128D includes a 1571 drive, it is more expensive than its predecessor. With the 128, a 64 user could buy the 128 and use his or her 1541 drive with the system.

There's another problem with internal drives: If the drive needs to go to the shop, the computer goes, too. Also, the internal 1571 is missing the external DIP switches found on the stand-alone 1571s that make changing device numbers so easy. But these are minor inconveniences found in most similarly configured systems.

The 128D looks like a real winner to us. It's nicely designed and is fully compatible with the 128, and offers significant enhancements.

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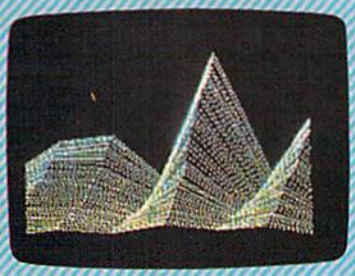

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SCIENTISTS A
STOP THE AGI

Time passes. Things get old. Let's face it, even Willie Mays retired. So there's no way your Commodore can compete with a newer machine, right?

Wrong.

The fact is that there's actually more power in your Commodore 64 or 128 than when you bought it. All you need is GEOS or GEOS 128 to find it.

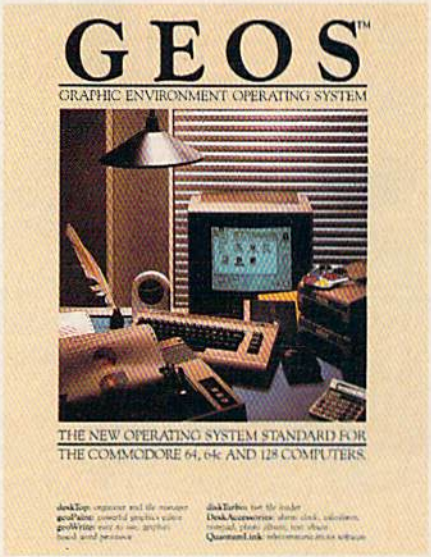
GEOS is the revolutionary operating system that works your hardware up to seven times harder than it's ever worked before. Loading. Processing. Accessing information. All at the mere touch of a mouse or joystick.

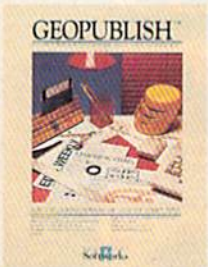
Time Warps Discovered

With GEOS, everything speeds up. Including you. Because the system is incredibly fast and ridiculously easy to learn: GEOS shows you options, you point at what you want and click your mouse.

End of lesson.

Now, once you know that, you know how every other GEOS application works, too. Like geoWrite, which lets you punch up paragraphs with five different fonts. Or geoPaint, which dresses up diagrams with an arsenal of artistic appliances. Both are built right into the GEOS disk. And when you put them together with geoWrite Workshop's LaserWriter compatibility, every new GEOS document comes out looking like an old master.





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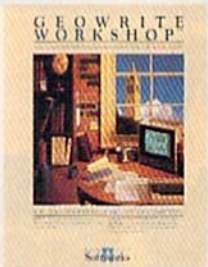
The GEOS-compatible, number-crunching spreadsheet for tracking and analyzing numerical data. Create your own formulas, perform calculations for anything from simple geometry to "what if" cost projections.



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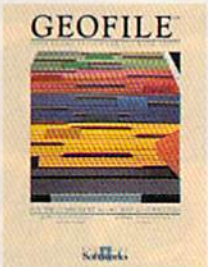
NEW All the GEOS-compatible tools a writer needs, including new geoWrite 2.1 with headers, footers, margins to 8" and features to justify, center, search and replace text. Includes a Text Grabber (for converting text from programs like Paper Clip), geoMerge and LaserWriter printing capability.



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The GEOS-compatible database manager that sorts, edits and prioritizes whatever data you feed it. You fill out the "input form," specify your command, and geoFile takes it from there.

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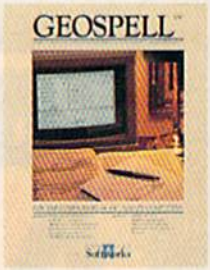

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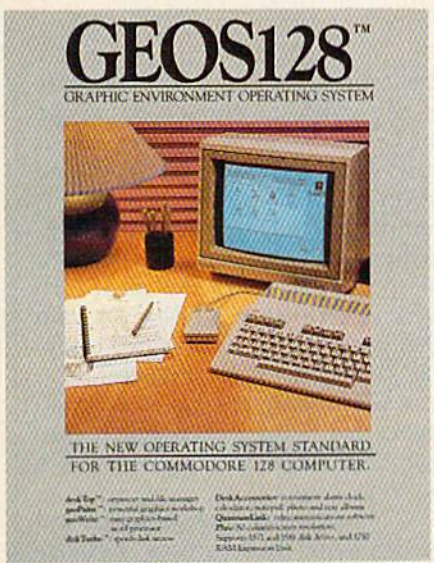
Avoid Old Age Forever!

But how does all this affect your Commodore's future? Well, it means you don't ever have to worry about it becoming obsolete, because there are all kinds of GEOS applications for almost every purpose.

You can finally get organized with geoFile, the database that searches, finds and lists almost anything that you want to search, find and list. You can manipulate mathematics or figure out financial formulas with geoCalc. If writing's your style, geoWrite Workshop can help you hammer out any kind of report. And geoPublish is the desktop publishing program that is still making headlines throughout the entire industry.

Of course, that's merely a sampling of what the GEOS environment has to offer. Because even as you read this, legions of our engineers are hard at work, developing even more GEOS applications for even more uses.

All of which means you get a whole lot more out of your Commodore than you ever bargained for. And while that may not actually keep your Commodore from getting older, that's certainly something it could live with for a long, long time.



128 version features 128K memory, full 80 column screen, supports 1571/1581 disk drives. 1750 RAM expansion and runs at a full 2 MHz for lightning speed.

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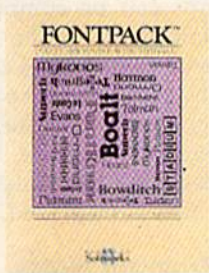

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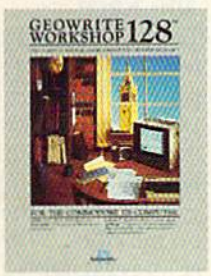

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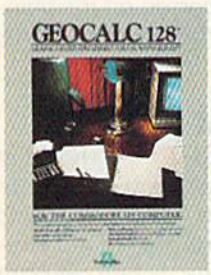

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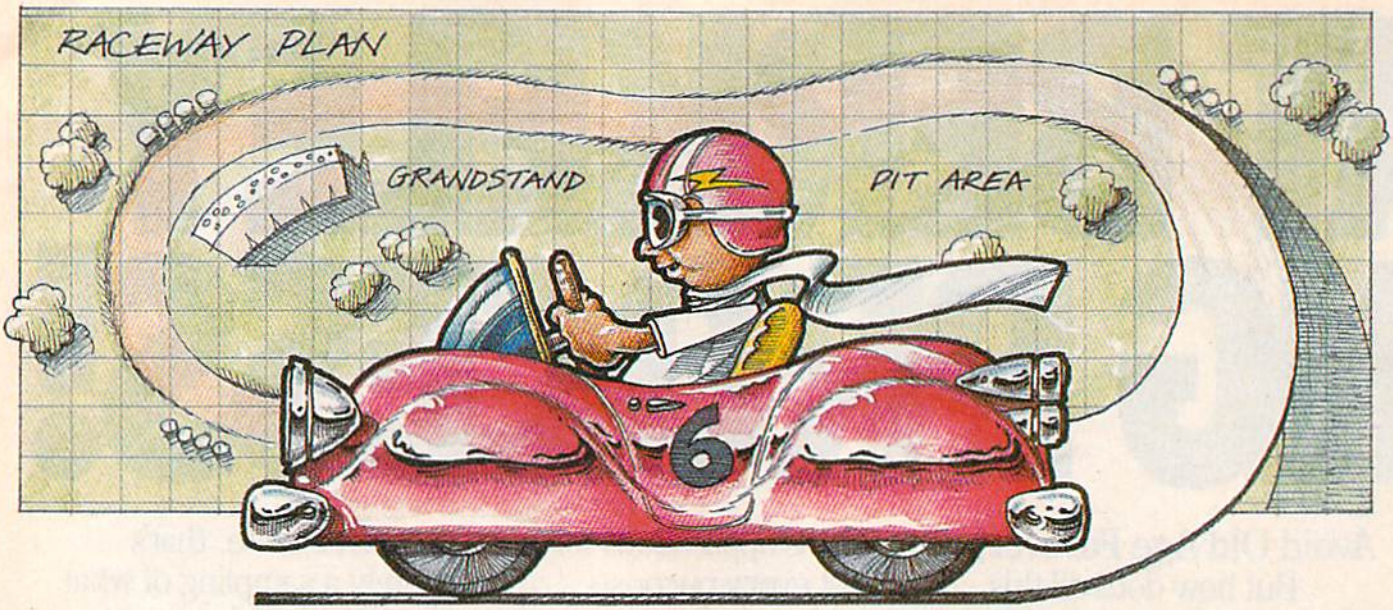

3-D Speedway

Chris Ulmer

This fast-paced, road-race game will keep you on the edge of your seat. You'll need quick steering and lightning reflexes to dodge the poles at the track's edge, avoid head-on collisions, and finish in the victory lane. For the 64 with joystick.

The year is 1992. Since the days of the Stanley Steamer, engineers have been trying to create the ultimate automobile. Early this year, such a car was finally created, with durability, efficiency, control, and *speed.* Cynics have doubts about the automobile's true performance, though, so the car must be entered in a race to demonstrate its technological superiority. A careful survey of the population has shown that you are the only person on the planet who can push this car to its limits, so you will drive in the big race.

Getting Started

Since "3-D Speedway" is written in machine language, you'll need to enter it using the "MLX" machine language entry program found elsewhere in this issue. When you run MLX, you'll be asked for the starting and ending addresses of the data you'll be entering. Here are the values to use for 3-D Speedway:

Starting address: C000
Ending address: CE67

Follow the MLX instructions carefully, and be sure to save a copy of the 3-D Speedway data before leaving MLX.

To load 3-D Speedway, type LOAD "*filename*",8,1 (for disk) or LOAD "*filename*",1,1 (for tape), where *filename* is the name you used when you saved the 3-D Speedway data. To start the game, type SYS 49152 and press RETURN.

The Race

The race is held in a large, flat valley with a circular track marked by poles. At the top of the screen, you'll see displays for the time remaining for each lap and the number of laps completed. When the game begins, there are 46 seconds on the clock. With each lap, the timer is reset with three seconds less than the previous lap. For example, 43 seconds are allotted to complete the second lap, 40 seconds to complete the third, and so on.

The game's goal is to complete each lap in the time given and to travel as far as possible before time runs out. Crashing into other cars or the poles on either side of the road doesn't count against you—it only slows you down by about one second per crash. Each time a lap is completed, the lap counter is incremented, the time counter is reset, the poles that mark the track turn white, the hum of the engine changes to a medium-pitched bleep, and the border color changes.

Controlling the car is easy. To steer, use a joystick plugged into port 2; to accelerate, press the fire button.

The first two laps aren't critical in achieving high scores, because even with several crashes, these laps can be completed within the time limit. In the later laps, however, two crashes can mean the difference between stopping or progressing to the next lap. At the end of the game, your total score, based on the distance you've travelled, is displayed.

Program Notes

To create the effect of motion on the road, two sprites which look like poles are moved rapidly down the screen in the pattern of a curved track. Even though there are only two sprites, the illusion of a line of many poles is created.

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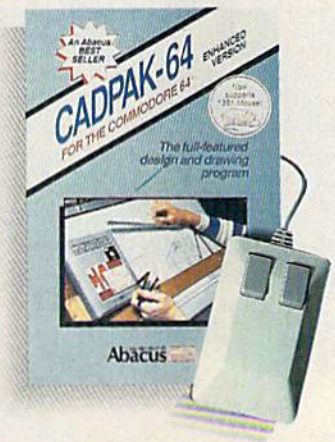

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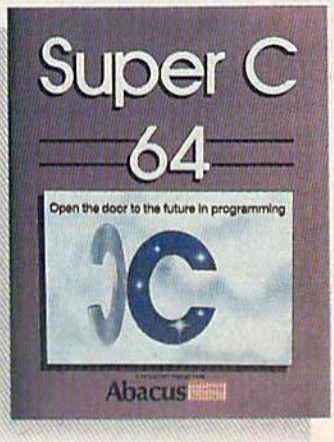

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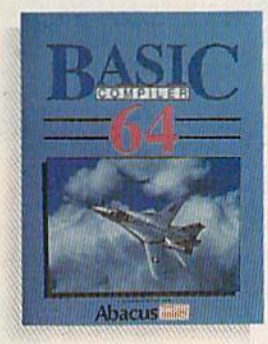

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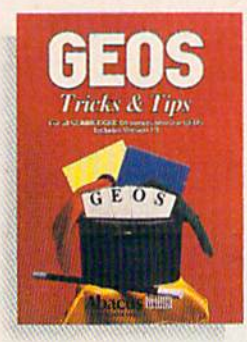

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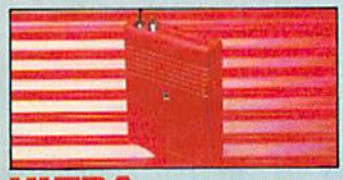

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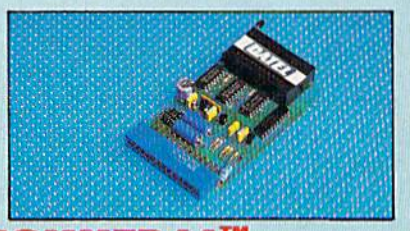

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To explain this phenomenon, we need to understand that a monitor or TV creates an image by shooting a beam of electrons—called a *raster*—at the screen, scanning back and forth from top to bottom, causing the phosphors to glow. Each time a scan is made, the screen glows but quickly begins to dim. If the screen was scanned only once, it would glow for a very short time and soon become dark. In order to make a solid image, most monitors and TVs scan the screen 60 times per second so that no dimming effect is noticed. In other words, the image is refreshed before it has time to fade.

To make the road appear solid, both poles are plotted and left for almost enough time to allow one raster to draw them, then they're moved a few pixels down the screen to a new position. This happens so quickly that certain positions coincide with raster positions, and our eyes perceive a number of poles instead of just two. Though rasters can produce terrific effects when done with machine language, BASIC is too slow for raster chasing.

Another effect which enhances the illusion of motion is the scrolling of mountains in the background. Mountains can be moved by creating a string of graphics characters resembling mountains and using a statememt like BASIC's MID$ to show different slices of the panorama. 3-D Speedway uses horizontal scrolling to shift the entire screen by eighths of a character before shifting whole characters.

Horizontal scrolling is controlled by register 22 of the VIC chip, at memory location 53270. You can experiment with horizontal scrolling by typing POKE 53270,192 + *n*, where *n* is a number between 0 and 7.

See program listing on page 87.

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Spy Defense

John Dalton

If shoot-'em-up arcade games are your weakness, this exciting action game for the 64 will provide you with a challenge that will make you come back again and again. Joystick required.

Fighting aliens is a dangerous job, as we've all seen in the movies. For some reason, aliens always have an incredible variety of weapons at their disposal: death rays; regenerating tails that detach to soar like rockets toward their enemies; or perhaps toxic, sulfuric breath. It's a wonder the humans ever win.

But this time, we have you, the official Spy Defender, to help humankind. It's a good thing you're here, too—these particular aliens have caught several of our best spies and are holding them in a prison that's sealed off by several fiery pits. Your job is to save the spies, but be careful—as always, the aliens have some surprises up their sleeves.

Getting Started

To type in "Spy Defense," you need to run "MLX," the machine language entry program found elsewhere in this issue. When prompted, enter the starting and ending addresses for Spy Defense:

Starting address: 0801
Ending address: 1740

Be sure to save the program before leaving MLX.

Although Spy Defense is written in machine language, it can be loaded, saved, and run like a BASIC program. When you're ready to play, plug a joystick into port 2, load the program, and type RUN.

Spy Defense begins with a title screen. Press f1 (or the fire button) to start, and press CTRL-C (or RUN-

Scoring Table

White Alien	5	Constructing a Bridge Section	20
Yellow Alien	5	Completing a Bridge	200
Cyan Alien	10	Bonus: Spy Crossing Pit	750x(Pit #)
Blue Alien	25	Bonus: Spy Reaching Base	10,000
Sparkling Alien	50		

Game Progressions

Pit	Number of Aliens	Ship's piece capacity	Size of Pit	Game Speed
1	2	3	7	slow
2	2	4	9	normal
3	3	4	11	medium
4	3	5	13	advanced
5	4	5	15	quick
6	4	6	15	fast
7	4	6	15	very fast
8+	4	7	15	maniacal

STOP) to quit. These keys can also be used during play to reset or exit the game. Press the SHIFT-LOCK key to pause the game. Release it to resume.

Your Mission

It is the year 2020. Our world has undergone some dramatic changes. It is a world of intrigue and suspicion, and there looms the possibility of a hostile war. During a routine scouting mission, several of our spies were abducted. Before your mission, you discover a secret that the enemy is trying so desperately to protect. They have a new ally: aliens from outer space.

As you fly your craft over the enemy's prison camp, above the blazing fire pits that keep the spies from escaping, you consider your task: to rescue as many spies as possible.

You're flying the newest spacecraft, a Laser Striker. You've flown simulations before, but never the real thing. A Laser Striker is capable of firing deadly laser beams. For this mission, your craft has also been outfitted with a device to allow you to drop special heat-resistant ceramic bricks into the fire pits. Drop enough to make a bridge, and the spies will be able to cross the pits.

Your task would be easy if you didn't have to worry about the enemy's new ally, the aliens. The aliens try to collide with you to cause damage. Some alien ships are able to drop charges which destroy your ceramic bricks. However, after a bridge is built and the fire is completely covered, these bombs are harmless.

At The Controls

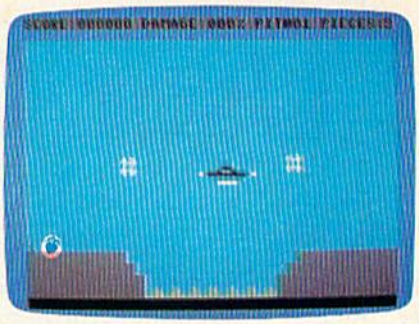
You control your Laser Striker with your joystick. All the action is monitored on your detailed radar screen. To fire a phaser, press the trigger and press the joystick left or right. To drop a bridge piece, depress the trigger and press the joystick down. You must release the trigger in order to fire again or drop another piece.

Should you become low on bricks or be seriously damaged, dock with the supply satellites which occasionally fly across the top of the screen. Docking will give you more bricks and repair about one-quarter of your ship's damage. After a spy safely crosses a pit, your ship will receive further repair. As the game progresses, your ship's capacity to hold bricks will increase, but so will the speed and number of aliens and the size of each pit. Remember, you only have one Laser Striker—when it is destroyed, the game is over.

Helpful Hints

Following are some important game aspects you might want to consider to achieve better scores:

• In good condition, your ship's outer color will be gray. After some minor damage the color will become a flashing red. In critical situations, your ship will flash many colors.



Alien spaceships, flanking your craft, make it difficult to recover your spies.

• Since aliens always appear at the top or the sides of the radar screen, try to stay away from these edges.

• A supply satellite will come by only after you shoot a certain number of aliens.

• Colliding with an alien will cause nearby aliens to be destroyed. A quick collision will give you some time to build your bridge before more aliens arrive.

• Use the time while the spy is crossing the bridge to shoot aliens. This will cause a new satellite to appear. Dock with it for a fresh supply of bricks for the next pit.

See program listing on page 84.

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User Group Update

Mickey McLean

This list includes updated entries to our annual "Guide to Commodore User Groups," which last appeared in the May and June 1987 issues.

When writing to a user group for information, please remember to enclose a self-addressed envelope with postage that is appropriate for the country to which you're writing.

Send typed additions, corrections, and deletions for this list to:

COMPUTE! Publications
P.O. Box 5406
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Attn: Commodore User Groups

User Group Notes

The Commodore Owners of Marysville, Port Huron (COMP) has changed its address to: 2937 W. Woodland Dr., Port Huron, MI 48060.

The correct name of the Commodore User Group in Fanwood, NJ is **Data Exchange-Beneficial Users Group 64/128 (D.E.-B.U.G. 64/128)**.

The **C-64 User Group of Orange County** has moved. Its new address is 74 Cardinal Dr., Poughkeepsie, NY 12601.

The new address for the **Tulsa Area Commodore Users Group (TACUG)** is P.O. Box 691842, Tulsa, OK 74169-1842.

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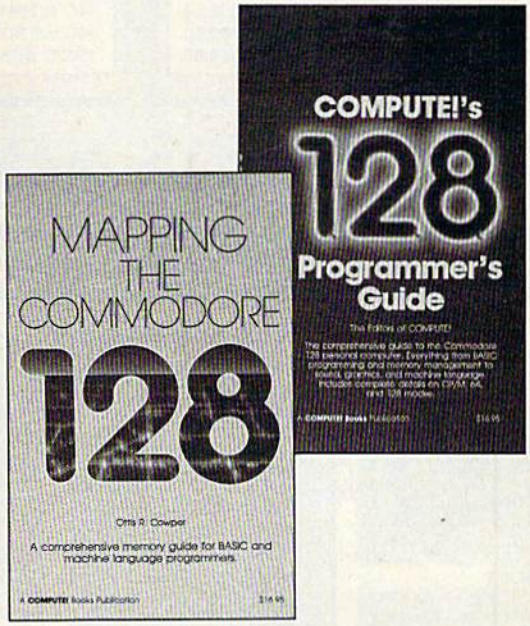

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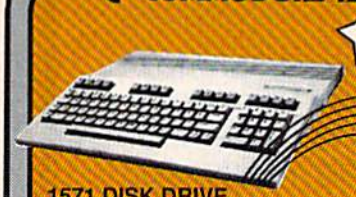

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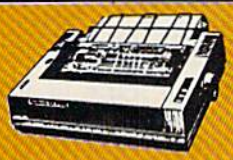

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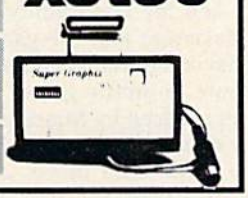

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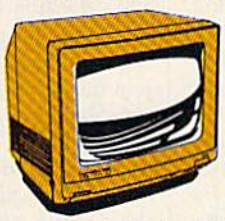

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Paperboy And *Gauntlet*

The best coin arcade games, it seems to me, are those whose play you can come to terms with pretty quickly, but whose mastery takes time. You ought to be able to invest a dollar's worth of quarters and get a good feel for the game, and then spend subsequent dollars on the improvement of your skills—always heightening your score.

Two games that succeed admirably in the coin-op parlors are *Paperboy* and *Gauntlet*. Now Mindscape has brought both games home, and has done so without reducing their playability in the least.

Extra! Extra!

Paperboy always struck me as a phenomenon. Here is a game of skill, rather than violence, in which earnestness counts for more than weaponry. Although there are some semi-violent encounters in the coin-operated version, the game's main thrust is always that of service: Players must deliver the newspaper to their customers.

Paperboy

Amazingly, this simple idea struck a responsive chord in arcades. The *Paperboy* game is nearly always crowded, its till fed by a constant stream of quarters.

Mindscape's translation of the game to home computers delivers all of the challenge of the coin version. It's just as hard on the 64 to maintain balance, avoid obstacles, and fling the newspaper accurately. It's no easier on a 64 to hit your customers' porches and not their windows. Just as in the coin-operated version, customers who do not receive their papers cancel their subscriptions.

For paperboys—and papergirls—who survive the perils of their route, there is a practice run where skills can be honed, abilities fine-tuned.

The graphics and animation are excellent, as are the game play and bright music that accompany the action. Joystick commands are simple and sensible. Mindscape's documentation is brief, but, then, *Paperboy* has always been a minimalist sort of game. Get on your bike and get to work: That pretty much sums up *Paperboy*'s objectives.

The Gauntlet Is Thrown

If *Paperboy* offers a modern adventure, *Gauntlet* returns to ancient times for its sources. Another arcade phenomenon, *Gauntlet* offers fast action, multiple screens, and the opportunity for additional players to join the game at any time. That sort of camaraderie was, and still is, rare in arcade games, and it is nicely reproduced by Mindscape in the home computer version.

The game itself moves at a more furious pace than *Paperboy*. *Gauntlet*'s heroes are assailed by all manner of villains, including ghosts, demons, sorcerers, and even Death itself. The villains have different capabilities and present the heroes with various challenges and perils.

Select your hero from these legendary characters: Thor, who possesses great strength, as well as a battle axe that can destroy monster generators, and who serves well in hand-to-hand combat; Merlin, whose mastery of magic makes him a powerful weapon against monster generators, but whose physical vulnerability makes him an easy target for the enemy; Thyra, whose Valkyrie prowess with the sword and moderate magical ability make her an effective weapon; and Questor, an elf who is capable of working strong magic.

Dungeon Drama

Gauntlet challenges players to penetrate the depths of a multilevel dungeon, destroying monsters and generators while collecting artifacts that aid in the quest. Foes have several levels of strength; some are easily destroyed, others more sorely test your mettle. Each level must be explored—while combat proceeds—in search of entry to the next level. There are traps and terrors scattered on the floors of each level. Tread carefully!

Gauntlet

This kind of action, as you can imagine, takes a lot of energy. Fortunately, *Gauntlet*'s designers have included food and beverage among the items to be gathered during the quest. Unfortunately, some jugs that look like cider actually contain a poison that robs heroes of powers and health points. And maintaining health and strength is at least as important in this game as destroying monsters and collecting treasure.

Like the arcade version, this edition of *Gauntlet* allows new players to join the game at any time. There can be two players at once. *Gauntlet*'s universe is sufficiently complex and dangerous to make it advisable to take a friend along. Solo gameplay is exciting, but this is the sort of game where two heads—and heroes—are better than one.

I like both of these games a lot. My nine-year-old son is even more devoted to them. While we still play the actual arcade versions when we happen upon them with quarters in-hand, there's something satisfying—not to mention economical—about being able to boot up an arcade favorite whenever we wish. Besides, the hot dogs at home are a lot better than those at the game parlor.

Mindscape has done a fine job of bringing *Paperboy* and *Gauntlet* home, where they belong.

—*Keith Ferrell*

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Echelon

There are many reasons for liking *Echelon*, but the fact that it is called a space-flight simulator is not one of them. First, it is impossible to simulate what has never been—although it is possible to design an advanced combat craft and then put you in the pilot's seat. Second, the game's C-104 Tomahawk has a ceiling altitude of 13,500 meters, hardly high enough to be called space.

That quibble aside, I admit it is much easier to say what *Echelon* is not, rather than say what it is. If a computer can be called an Anything Box because it can be programmed to do almost anything you can imagine, *Echelon* comes very close to being an Anything Game.

The scenario is simple: Stationed on Isis, the tenth planet of our solar system, you must fly the sole patrol craft in Zone 106. Your mission is twofold: You must explore the planet and do battle against the space pirates; and, in your spare time, find and interpret clues that will lead you to the pirate's stronghold.

LipStik is a unique input device that Access includes with the Echelon *package. It's also available separately.*

To accomplish the mission, you have the Tomahawk near-space craft, powered by nuclear engines, fitted out with a variety of weaponry, linked to the main computers at Echelon headquarters, and loaded with scanning equipment. And, you have LipStik, an innovative control interface.

At the outset, you can choose the kind of game you wish to play by pressing the DataLink key. This brings up an options screen from which you can select a mission that is Scientific, Patrol, or Military. The first contains no combat and can be used to explore the planet, to fly obstacle courses, or to collect artifacts. The next two contain different degrees of armed action, and these are further subdivided by allowing you to choose the strength and expertise of the enemy.

Echelon offers a target range where you may practice firing without being fired upon, as well as an area for practicing touch-and-go landings. You can fly under bridges and through tunnels while watching yourself on TV from an RPV (Remote Point of View) vehicle. To go more quickly from one planetary area to another, you also have the ability to teleport.

The three main areas of the game, which can be used singly or in combination, are flight simulation, arcade action, and puzzle-solving. It is possible simply to fly the Tomahawk, which in itself can be an enjoyable experience, but it is even more fun to fly in an arcade action sequence where space pirates are coming at you from all directions. In the most complex combination, you may want to fight off pirates while trying to gather enough of the 240 artifacts on the planet's surface to be able to solve the mystery and locate the pirate stronghold.

Your view throughout consists of two screens and a control console. The main viewing screen shows what is ahead of you; pressing the proper numerical keys shifts that view to the rear, to either side, above, and below. A smaller screen shows your craft as it appears from above, sometimes known as a satellite view. An interesting feature is that this second screen can be toggled off, allowing the main screen to update more often and, thus, provide for faster action. (If you select an arcade scenario, planetary surface features can also be excluded for the same purpose.)

The console itself provides information on fuel, weapons, altitude, attitude, shield levels, X and Z coordinates, scoring, and game clock. As for the game clock, there is no time limit, save what you set for yourself. Start the clock running and see how long it takes to gather all the artifacts, for example. Next time, try to do better. Should you have to save a game, the current time will also be saved, allowing you to pick up where you left off.

Outside the main viewing screen is the surface of Isis, represented as a blue-on-black grid. Topography is represented by wire-frame mountains in red, while alien-made (as in *man-made*) objects—including enemy spacecraft—are a combination of red and yellow. It is a color scheme that works well. One anomaly: While the wire-frame mountains appear as solid as those in other recent simulators, it is possible to fly through them.

A keyboard overlay (which will fit on a 128) helps you keep the various commands straight, while a large map with only 9 of the 36 sectors completed will allow you to pencil in the results of your explorations. The third item of hardware is LipStik.

My first thought on opening the game was that LipStik was a cute but probably useless gimmick. It is not. Consisting of a dummy headset and a real microphone, LipStik plugs into joystick port 2 (your joystick is in port 1). Its sole purpose is to provide a second "button" for firing weapons. The button on the joystick has to be used for other purposes in *Echelon*, and weapons are fired by pressing the *F* key. Since the action can get rather fast and furious, it can be difficult to keep your sights aligned on a pirate when you have to use one hand on the keyboard—thus, LipStik.

Echelon, *a futuristic flight simulator, features game qualities and 3-D graphics.*

The device responds to anything you say, such as *Fire!*, *Rats!*, or *Aunt Harriet is coming to visit!* (Try to avoid words of multiple syllables as they deplete your ammo faster than you may want.) The point is that it works, it works well, and it is a real help. While the documentation refers to it as a second fire button, it is equally proper to think of it as a third hand.

Echelon's documentation is very good. There is a quick kick-the-tires-and-light-the-fires routine as well as more detailed instructions for getting your ship off the orbiting base. There are good sections on such routines as combat, use of the RPV, use of the teleporter, docking maneuvers, and so on. There is an even deeper section on interpreting the pirate code to be found on certain artifacts, making cryptography another optional part of the game. There is even a section on the history of Isis.

The 3-D graphics are very good, as is the sound. The firing of weapons, the resultant explosions, and the acceleration and deceleration of the ship all have their own routines, combining with the other game features to provide an experience that is both rich and rewarding because it offers something for just about everybody.

—Ervin Bobo

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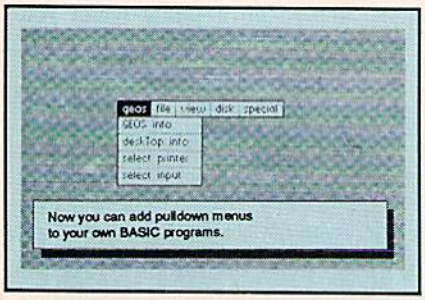

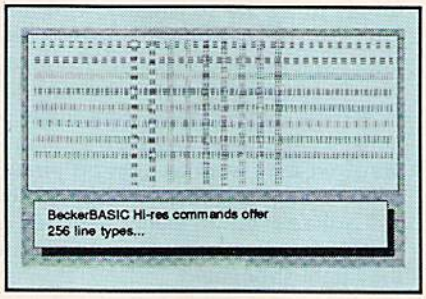

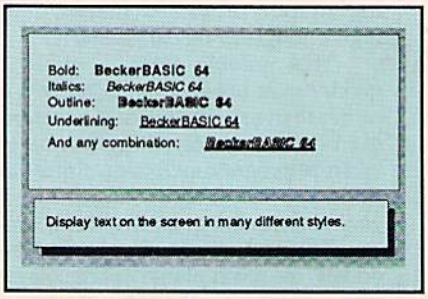

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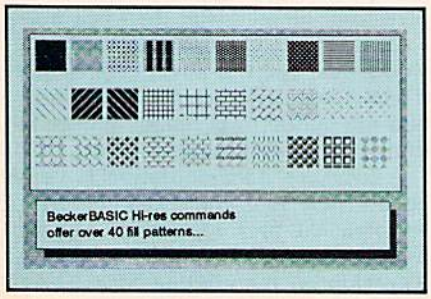

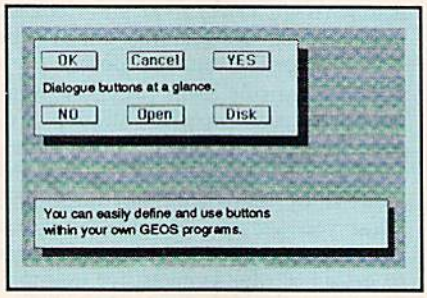

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Halls Of Montezuma

The boys from down under have done it again. In the tradition of *Battlefront*, *Carriers at War*, and *Europe Ablaze*, the Strategic Studies Group (SSG) from Australia has concocted another winning strategy war game in *Halls of Montezuma*.

Halls of Montezuma uses the "Battlefront Game System," developed by SSG, and is a battle history of the United States Marine Corps. As usual, the group has learned from previous games and has improved on an already excellent system. This game achieves a new high in simplicity of operation, but without compromising the control demanded by serious war gamers.

Your role is the commanding general of various Marine components, as you retrace the Corps' colorful past, with historically accurate scenarios from Mexico in 1847 to Vietnam.

If that's not enough, *Warplan*™, a detailed war game construction set, lets you edit the existing scenarios and create new battles to fight.

Want different icons or new map symbols? Try using *Warpaint*™ to create your own map symbols and icons.

The *Halls of Montezuma* package consists of an instruction manual, a map of the battlefields, two menu reference cards, and labels for identifying your disks containing saved games.

The scenarios begin with the 1847 assault on Mexico City, the culminating battle of a three-year war with Mexico that began at the Alamo in Texas and ended with the Marines storming the *Halls of Montezuma* in Mexico City.

Belleau Wood is the World War I representative. This was a major battle in which the Marines were instrumental in crushing the last chance for a German victory.

The World War II scenarios include the bloodiest fighting of the war: Iwo Jima, the Shuri Line, and the Final Redoubt on Okinawa.

The Marines' participation in the Korean conflict is represented by the landing at Pusan.

Finally, the battle for Hue in Vietnam ends the historical scenarios.

The manual includes a tutorial to get you started, then continues with an informative chronological history, which ties the represented battles together. SSG has a tradition of presenting game manuals that not only prepare you to play the game, but also provide fascinating historical insight.

Each scenario described in the manual also includes a short briefing to give you an idea of what must be done to achieve victory.

The Battlefront Game System provides an easy-to-use interface for players. SSG claims you can be playing in ten minutes, but to master the game and develop winning stategies will take considerably longer.

Each scenario may be played by two players, or by one player against the computer. You may select to command either side when playing against the computer.

The degree of difficulty is selected from a menu. You may choose to give your computer opponent almost insurmountable odds, or you may handicap it significantly. The same handicapping system may be employed in a two-player game.

After selecting the scenario and the degree of difficulty, you begin play by issuing orders to the regimental commanders of each of your divisions. They in turn relay your orders to their assigned battalions. Just as a field commander must do during an actual campaign, you'll have to keep in mind such factors as fatigue, supply lines, and replacements, as well as augmenting your support forces effectively. Don't constantly order your regiments into unrelenting attacks, or you'll find they'll take heavy casualties as fatigue becomes a factor.

Halls of Montezuma *achieves a new high in simplicity of operation without compromising the control demanded by serious war gamers.*

It's also necessary to rotate your regiments to the rear occasionally, allowing them time to rest and regroup before rejoining the fray. Rotate your units too frequently, and the result will be chaos as they struggle to regroup.

Your regimental commanders will do their best, in the Marine Corps tradition, to carry out your orders to defend captured territory, withdraw, or attack with varying degrees of intensity.

You also may order your headquarter units to relocate. Keep them in contact with their deployed regiments in order to keep open lines of communication and supply, but be careful not to place them in areas where they will come under direct enemy fire. Loss of an HQ will result in reduced effectiveness of the remaining regiments, causing the troops to be easily routed.

When a regiment is in contact with an enemy force, you may elect to assault a particular unit in the enemy line or choose from other available orders.

Each battle consists of 4 movement phases or turns each day, with up to 99 turns in a scenario, for a maximum of 25 days. Each scenario lasts a set number of turns, with the average being 10 days. Usually, in solitaire mode, a game may be played comfortably in one evening.

Your goals are to capture as many specified objectives and destroy as many enemy battalions as you can—and to prevent the enemy from doing the same to you. Victory points are awarded after each round, and the player scoring the most points at the end of the game is declared the winner.

The Marines are still looking for a few good men ready to answer the cry of "Semper Fi!" and *Halls of Montezuma* is a worthy battleground.

—George Miller

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The Sentry

Unique is an overused word. Despite advertising claims, it's rare that a *truly* unique game is released. Many games have innovative features or include advances in the interface, but most gaming concepts are by now pretty well established. War games, sports games, adventure games, role-playing games, shoot-em-ups, simulations, jumping games, converted board games—these categories all have a ready base of buyers, and the software producers know it. For precisely that reason, an honestly innovative game rarely gets the attention it deserves—if it doesn't fit into established categories, no one seems to know what to do with it.

One of the problems with unique games is that learning to play them takes a little time and work, and increasingly, work is becoming anathema to computer gamers. With all the games available, it seems pointless to expend any energy to bring a game to the point at which it becomes enjoyable. For most people, game time is stolen time: It's only natural to want the theft to be worthwhile.

That's the opposition a game like Firebird's *The Sentry* must be prepared to fight. *The Sentry* is one of those rare games that truly rewards repeated play—a game that emphasizes fast-paced strategy without the need for learning a host of rules. In its player-perspective graphics display, extreme ease of play, and ability to addict—all without requiring players to fire weapons or simulate reality—*The Sentry* is one of the most important games of the past few years.

Its basis is, quite simply, the first law of thermodynamics. You play the role of a lone synthoid, moving through 10,000 different landscapes, trying to absorb the enemy. The enemy consists of a Sentry and (usually) one or more Landgazers who rotate like beacons and absorb alien presences (i.e., you). The trick is to absorb the Sentry before she absorbs you. As you might guess, such a simple concept is far from easy to implement.

Each landscape contains the Sentry, the Landgazers, and trees. Scenes are three-dimensional and divided into squares in several elevations. You enter each landscape fairly well hidden from the Sentry's gaze, but to absorb her, you can't stay hidden for long.

The Sentry *is one of those rare games that truly rewards repeated play. It is one of the most important games of the past few years.*

Absorption is possible only from an elevation higher than the object you want to absorb. What you must do, then, is climb from elevation to elevation until you reach a point higher than the Sentry. As soon as you do so, you can absorb her.

The problem is, she has the same idea. As soon as she sees the square you're standing on, she can begin to absorb your energy. If she can't see you, often her Landgazers can. And if they can see you but not the square you're on, they can turn a nearby tree into a Meanie. The Meanie will focus in on you and hyperspace you to some other place on the landscape. Usually, hyperspace transports you to a lower level. If you're already low on energy, the hyperspacing will destroy you.

Now, keeping away from these things is hard enough, but it's even worse when you consider that you (the synthoid) can't actually move. To change locations, you have to concentrate your energy on a square (one you can see) and create a new synthoid (by pressing a key). Then, immediately, you must press another key and project yourself into the new synthoid. You will end up facing the old synthoid, which you can reabsorb into the new one. You lose no energy for this as long as the Sentry or the Landgazers do not absorb your old synthoid first.

Also, you can create trees and boulders. Creating a tree will give you something to hide behind should the Enemy's gaze be narrowing in on you. Creating boulders is necessary to move from one elevation to the next. Because your synthoid is not tall enough to see to the next level, the normal procedure is to create a boulder first (or maybe two) and then create the new synthoid on top. From the new vantage point, you can see new squares on higher elevations.

All of this is extremely easy to do, but the strategies of climbing and absorbing remain constantly fascinating. At any time, you can point the cursor into the sky and ask for a bird's-eye view of the landscape. This will give you a good idea of where you are on the landscape, and it will also give you time to plot your next series of moves. With the Sentry and up to six Landgazers looking for you (six is the most I've encountered), and all of them rotating at different times and in different directions, forming a strategy is essential.

As if the game weren't innovative enough, the Game Save feature is simply brilliant. When you absorb the Sentry in each landscape, you project yourself into a new synthoid atop her tower, and then hyperspace off the landscape. The game then gives you the secret entry code to a brand new landscape. There is no way of obtaining these entry codes without actually earning the right to have them. Then, when you restart the game, to move to the new landscape you simply type the landscape number and its associated entry code. No blank formatted disks are required, yet the game gives you a constant sense of progress.

The Sentry contains 10,000 landscapes. To write this review, I worked through almost 100 of them. Each time I succeeded, usually after four to eight tries, I entered the newly revealed landscape and tried again. The game is addictive, and even though absorbing Sentries grows a bit stale after a couple hours of solid play, you will find yourself drawn back again and again. In this way, it is perfect for late-night play when you have a half-hour or so and want neither another baseball game nor a complex, mind-boggling war game. Challenging, innovative, and extremely well-executed, *The Sentry* is excellent entertainment.

—*Neil Randall*

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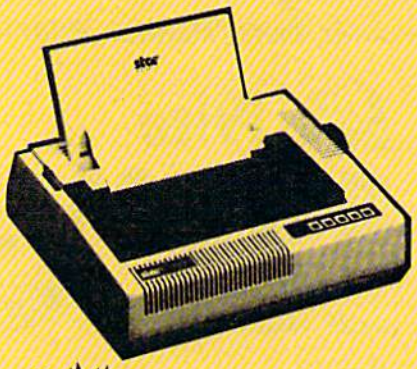

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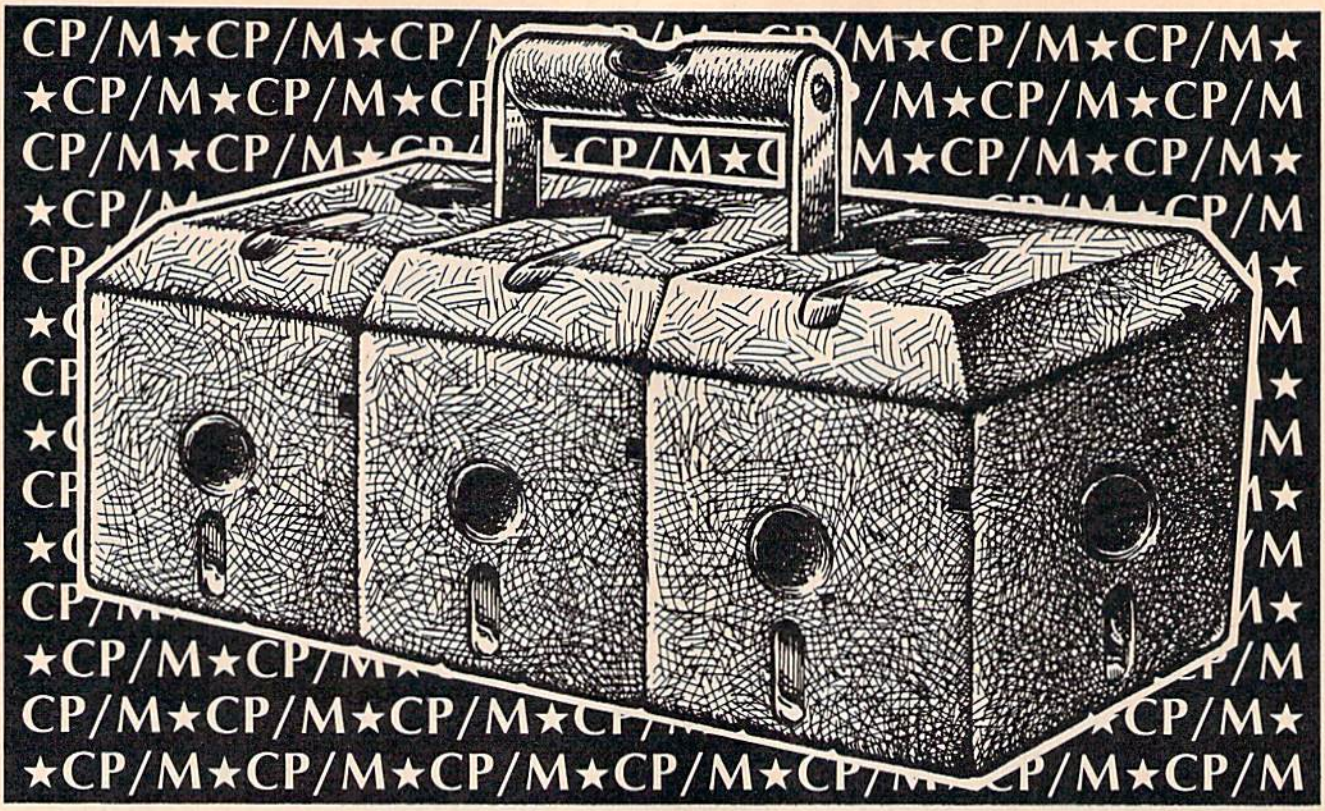

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Part 2: Programmer's Toolbox

Clifton Karnes, Assistant Editor

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The first installment in this two-part series explored topnotch writer's tools for the 128's CP/M mode. This month we'll focus on the best CP/M programming tools. We'll look at three versions of BASIC, two text editors, an unusual productivity aid, and we'll top things off with a roundup of programming languages currently available for the 128's CP/M. Let's begin with the BASICs.

CBASIC, MBASIC, And EBASIC

Most microcomputers come with some version of BASIC, and as a consequence, most microcomputer users interested in programming are familiar with BASIC. One of the few disappointments with the 128's CP/M is that the package doesn't include a version of CP/M BASIC. Many people have avoided the 128's CP/M for this reason alone, but for those who want to make a modest investment, there are now three excellent versions of BASIC available. Two are CP/M classics and one is a public domain "best buy."

The two classic versions of BASIC for CP/M are MBASIC and CBASIC. Quite a bit of CP/M public domain software has been written in one or the other of these two languages, and having both is a double pleasure. Fortunately for us, Osborne bundled *both* versions with its computers, and PDSC—the people mentioned in the discussion of *WordStar* in Part 1—is offering both CBASIC and MBASIC for a very affordable price, $39.95.

CBASIC is a semicompiler. It takes source code prepared with a

word processor or text editor and compiles or translates it into a language that the CBASIC runtime module executes. This system has two benefits. First, the REMarks, spaces, and other niceties that make BASIC interpreters run more slowly are no problem with a semicompiler like CBASIC. Since a semicompiled version of your program is created from the source, all the REMs, spaces, and so on that make BASIC more readable, but slow it down, are eliminated.

Another nice feature of a semicompiler like CBASIC is that line numbers aren't required. They can be used if you wish, but the language doesn't need them the way an interpreter does. The second important thing about semicompiled BASIC programs is that they usually execute faster than interpreted BASIC.

MBASIC stands for Microsoft BASIC and is the descendant of the original BASIC written in 1975 by Microsoft's founder, Bill Gates, for the IMSAI and Altair computers. It's a full-featured, powerful real-time interpreter, similar to the 128's BASIC 7.0 and the IBM PC's BASICA. MBASIC and CBASIC are not compatible with each other, but by having both, you'll be covering all the CP/M BASIC bases.

At the price PDSC charges, it can't afford to offer much support. Another source for MBASIC that does offer support is Workman & Associates. Workman publishes *Write*—a word processor we discussed in Part 1—as well as several other CP/M language implementations. For $125, Workman sells the latest release of MBASIC and offers full support.

There's one more BASIC worth mentioning: EBASIC, the public domain grandfather of CBASIC. EBASIC was the master's thesis of a promising young language designer, Gordon Eubanks, who later refined EBASIC into CBASIC, and is currently president and CEO of Symantec Corporation, makers of *Q & A*, one of the hottest PC products around. EBASIC is quite serviceable and widely available on bulletin boards and from other public domain sources. If you want to experiment with BASIC in the 128's CP/M mode and also want to cut expenses, EBASIC has much to recommend it.

Text Editors

If you're interested in programming in a compiled, semicompiled, or assembled language, you'll need a text editor to create your source code. You can use a word processor—like *WordStar* in its nondocument mode—but editors intended for programming often offer features missing from word processors.

When it comes to text editors, CP/M users are lucky because one of the best products available, VDE, is in the public domain. VDE is the work of Eric Meyer and is an exceptional piece of software. It is small (about 10K), fast, offers a wide range of features, and has some word processing capabilities.

Like most CP/M products, you'll need to configure VDE for your 128, but the process is automated and simple. VDE's commands are like *WordStar*'s, so if you're familiar with that structure, you won't have any trouble navigating VDE.

Here are just a few of the features VDE offers: full-screen editing, wordwrap and reformatting, margins, tabs, spacing, pagination, block copy, move and delete, macro programs, find and replace, undelete, disk support, window command, and several configuration options.

Eric Meyer is always improving VDE, so look for the latest version.

VEDIT

For those who want everything possible in a CP/M programmer's editor, there's VEDIT from Compu-View Software. It's expensive ($95 list), but it's one of the most powerful editors available for any operating system.

VEDIT has multiple windows, multiple buffers, keystroke macros, off-the-cuff macros, built-in macros, pop-up menus, cut-and-paste buffers, undo line changes, paragraph justification, online calculator, completely reconfigurable keyboard, and more. VEDIT is so powerful that it can easily be used for word processing as well as for editing programs.

One special feature of VEDIT is that it's not just an editor, it's also a programming language. The language VEDIT uses is a version of TECO (for Text Editor and COrrector), a programming language especially designed for text handling and originally developed for use on minicomputers. Writing any program that manipulates text is easier with TECO than with most any other language. Programming a text formatter, for example, is a complicated business in Pascal, C, or BASIC, but in TECO, it's easy.

If VEDIT sounds good but you're put off by its price tag, there's a way you can have much of VEDIT's power without paying $95. VEDIT is also available in a single-file (no windows) edition with a smaller macro language for $49. You can have much of VEDIT's power for a very reasonable price.

Write-Hand-Man

Write-Hand-Man (WHM) is a *Sidekick*-like utility for the 128/1571 in CP/M mode that offers a memory-resident notepad, a phonebook, a calendar, a directory, a calculator, a terminal program, an ASCII chart, keyboard macros, and the ability to run one application from inside another.

WHM sits in the 128's high memory waiting to be called by its trigger character. When the trigger character is typed, the current application is suspended and a menu appears in the upper-left corner of the screen. From this menu, you select the *WHM* application you want.

Applications are stored on disk as relocatable (.REL) files. When you make your choice from the menu, *WHM* loads and runs the application. When you've finished with a *WHM* application, you're returned to the *WHM* main menu. From here, you can choose another *WHM* application or return to the calling program just the way it was before you left it. Let's take a look at the applications.

WHM Applications

Notepad creates a window (8 lines by 32 columns) on the screen for each page of a notepad. You add pages as you type, the number of pages being limited only by your disk size. You can leaf through the notepad sequentially (forward or backward) or select pages randomly. *Notepad*'s editing controls are *WordStar*-like and include commands for printing and erasing pages.

Phonebook is like Notepad. The window is 12 lines by 32 columns, and each page holds phonebook entries for two letters of the alpha-

Programming Language Roundup

Product	Publisher/Vendor	Price	Description
BASIC			
MTBASIC	Softaid	$49.95	Multitasking compiler.
MBASIC	PDSC	$39.95	Microsoft BASIC interpreter. Package includes CBASIC.
MBASIC	Workman & Associates	$125.00	Same as above but with support available.
CBASIC	PDSC	$39.95	BASIC semicompiler. Package includes MBASIC.
EBASIC	Public Domain	—	Forerunner of CBASIC.
BASCOM	Workman & Associates	$212	Microsoft BASIC compiler.
NEVADA BASIC	Ellis Computing	$49.95	BASIC interpreter.
C			
Mix C	Mix Software	$19.95	Full K & R compiler with 400-page manual.
Small-C	Public Domain	—	Ron Cain's subset of C.
Hendrix Small-C	M & T Publishing	$37.90	Small-C extension. Requires Small-Mac.
Aztec C	Manx Software	$199.95	Everything you need for a complete C development environment.
BDS C	Workman & Associates	$135.00	K & R subset with floating point and very fast compile and execution speeds.
Toolworks C	Software Toolworks	$49.95	Integer-only C compiler. Compiles to assembler source which must be assembled to produce a .COM file. A Mathpak that adds floating point is available for $29.95.
LISP, Pilot, and Prolog			
XLISP	Public Domain	—	Experimental LISP.
LISP/80	Software Toolworks	$39.95	Good subset of INTERLisp dialect.
Nevada Pilot	Ellis Computing	$49.95	Educational language.
EProlog	Public Domain	—	Subset of standard Prolog. Includes Z80 source.
MicroProlog	Programming Logic Systems	$99.00	Full implementation of Prolog.
COBOL			
Microsoft COBOL	Workman & Associates	$175.00	Full COBOL implementation for CP/M.
COMOL			
Comol	Comol Users Group	$49.95	The famous 64 language for CP/M.
FORTRAN			
Microsoft FORTRAN	PDSC	$39.95	Fortran 77
Microsoft FORTRAN	Workman & Associates	$175	Same as above but with support available.
Nevada FORTRAN	Ellis Computing	$49.95	Fortran IV
Forth			
MasterFORTH	MicroMotion	$125.00	Forth-83
Ada, Pascal, and Modula-2			
Janus Ada	Workman & Associates	$79.95	The standard Ada for CP/M.
Turbo Pascal	Borland	$69.95	The standard for microcomputers. Request the Kaypro/128 patch when ordering.
Nevada Pascal	Ellis Computing	$49.95	Commercial version of JRT Pascal.
FTL Modula-2	Workman & Associates	$49.95	Includes editor, compiler, assembler, and linker.
Z80 Turbo Modula-2	Echelon	$89.95	Developed by Borland *(Turbo Pascal)*. Includes editor, compiler, linker, 552-page manual.
Assembly Language			
Z80ASM, SLRNK	SLR Systems	$49.95 each	Super-fast 8080/Z80 assembler and linker. M80 compatible.
Z80DIS	SLR Systems	$49.95	Symbolic disassembler.
DSD80	SLR Systems	$115.00	Z80 debugger.
ASM, MAC, SID (DRI)	DRI Special Offer	$19.95	Digital Research's standard CP/M assembler utilities.
Small-Mac	M & T Publishing	$29.95	Assembler to use with Small-C. Source code (in C) included.
Z80DIS	Public Domain	—	Z80 disassembler.

Publishers/Vendors

Borland International
4585 Scotts Valley Dr.
Scotts Valley, CA 95066

Comal Users Group
6041 Monona Dr.
Madison, WI 53716

CompuView
1955 Pauline Blvd.
Ann Arbor, MI 48103

Echelon, Inc.
P.O. Box 705001-800
South Lake Tahoe, CA 95705

Ellis Computing
5655 Riggins Ct.
Suite 10
Reno, NV 89502

Manx Software Systems
P.O. Box 55
Shrewsbury, NJ 07701

MicroMotion
8726 S. Sepulveda Blvd.
A-171
Los Angeles, CA 90045

Mix Software
1132 Commerce Dr.
Richardson, TX 75081

M & T Publishing, Inc.
501 Galveston Dr.
Redwood City, CA 94063

Poor Person Software
3721 Starr King Cir.
Palo Alto, CA 94306

Programming Logic Systems, Inc.
31 Crescent Dr.
Milford, CT 06460

Public Domain Software Copying Company (PDSC)
33 Gold St., Apt. L3
New York, NY 10038
(Be sure to ask for double-density disks.)

SLR Systems
1622 N. Main St.
Butler, PA 16001

Softaid
8930 Rt. 108
Columbia, MD 21045-2101

Software Toolworks
One Toolworks Plaza
13557 Ventura Blvd.
Sherman Oaks, CA 91423

Workman & Associates
1925 E. Mountain St.
Pasadena, CA 91104

bet. Pages are accessed randomly by letter. *Phonebook* also offers autodialing for Hayes-compatible modems. If one page for each two-letter pair is not enough room for you, there's another larger phonebook that has four pages for each pair of letters.

Calendar is a 14-day appointment calendar. Each day has a block of space (12 lines by 32 columns) for appointments. One useful feature is *Calendar*'s ability to copy the second week into the first week's space. With this, you can always have the current week as week 1.

Dir simply provides a directory listing much like CP/M's DIR, and *View* lets you view a disk file. *View* can move either forward or backward through the file, which makes it more flexible than CP/M's TYPE.

Calculator is a four-function floating-point calculator that allows numbers of up to 14 digits. The basic arithmetic functions of addition, subtraction, multiplication, division, and negation are supported. *Hex* is a hexadecimal (and decimal) version of the calculator for integers between $0 and $FFFF.

Termcomm is a simple, somewhat limited terminal program with no upload or download capabilities. *Termcomm* is distributed in assembly language source code and needs to be modified and assembled before it can be run. This means that to get *Termcomm* up and running, you'll have to know some CP/M-80 assembly language and have a relocatable assembler like RMAC, M80, or Z80ASM to assemble the source code. With *Phonebook*'s autodialing, you can autodial your number in that application and then move to *Termcomm* to communicate.

Keys allows you to define up to eight keyboard macros. The storage area for these keys is also used for cutting and pasting from *WHM* applications. You can cut and paste up to 95 characters between *Notepad*, *View*, *Calculator*, and your CP/M application.

ASCII displays an ASCII chart in hexadecimal. If you program, you probably need to look at one of these about ten times every day, and even though a chart may be in the back of nearly every computer book you own, one never seems to be around when you need it. *ASCII* is always there.

Swap allows you to execute one application from inside another. It works exactly as advertised, but should be used with care. If your swapped program alters the disk directory, you could cause yourself problems.

Modifying *Write-Hand-Man*

One nice thing about *WHM* is that the assembly language source code for the applications is provided on the distribution disk. This makes it easy to customize the supplied applications and to write your own. (You must change the file extensions from .MAC to .ASM to assemble them with RMAC.)

There is another interesting way to extend *WHM* that requires no programming. You simply find other uses for the supplied applications and rename them. For example, many people who write like to keep an alphabetized style sheet. The style sheet has information on it, such as which spelling is preferred when more than one is correct, which numbers are written as numerals and which as words, and so on. To create a *WHM* style sheet application, all you need to do is make a copy of PHONEBOO.REL and PHONEBOO.DAT and rename them STYLE.REL and STYLE.DAT. Now you have an alphabetical style sheet available at your fingertips.

You could also use PHONEBOO for any application that needs alphabetical access, like customized help utilities for programming languages or applications. Similarly, NOTEBOOK can be renamed and used for any information that needs numerical access. One thing to keep in mind is that all of these applications take disk space. And, although *WHM* can be used on a one-drive system, two drives or one drive and a ramdisk, will make life with it easier.

WHM's documentation is a light 47 pages, but it is clear and thorough. It's hard not to like *WHM*. It has something for everyone: business people, writers, and especially programmers. Poor Person Software has not only supplied useful applications, it's made it easy to create your own. This is one of the most useful software packages available for the 128's CP/M mode.

Do you have a question or a problem? Have you discovered something that could help other Commodore users? We want to hear from you. Write to Gazette Feedback, COMPUTE!'s Gazette, P.O. Box 5406, Greensboro, NC 27403. We regret that, due to the volume of mail received, we cannot respond individually to programming questions.

Organizing A Users Group

I am interested in starting up a user group and wonder if you could tell me how to go about it. Exactly what does running a user group involve? Are there any rules or regulations that must be followed in order to have a valid users group?

Glen L. Pittman

At the most basic level, a user group is just a group of people who own computers and get together to talk about them.

The first step is to find a place to meet (a restaurant, an empty classroom, or a computer store, for example) and advertise your first meeting. Ask computer stores if you could put up a notice. If you have a modem, leave messages on local bulletin boards.

There aren't any rules or regulations you have to follow. You can just meet once or twice a month to talk about computers if you want. It's not a bad idea to write a constitution describing the group's goals and officers' duties. You can charge membership fees. Many user groups publish a monthly newsletter, which may or may not contain advertising and reprints of articles from other user group newsletters. Many groups have a disk librarian who collects public domain programs for distribution to members. Some user groups buy disks and equipment at discount prices for resale to members. Some sponsor bulletin boards.

Once you get things moving, send a notice of your name and address to us (at the editorial offices in North Carolina) for inclusion in the monthly "User Group Update" column. Commodore occasionally makes special deals available to user groups, so you should also write to their User Group Coordinator.

Finally, you may wish to talk to a lawyer, to see if there are any benefits to incorporating as a nonprofit organization.

Bauds And Bips

From the many articles I've read in your magazine, it is obvious that the word *baud* does not properly mean *bits per second*. However, the meaning has apparently evolved so that, for all practical purposes, the two terms are interchangeable.

Could you please tell me the original meaning of baud and give the verdict on whether baud has come to mean the same as bps?

Danny Faught

Technically, the two terms have different meanings. The baud rate measures how many discrete signals are sent per second. Bits per second (bps) is an indication of how much information, measured in bits, is sent per second.

When you're using a modem at 300 bps, it transmits and receives 300 tones per second. There are two possible tones; the first represents a bit 0 and the second represents a bit 1. Since each tone carries one bit, 300 baud is the same as 300 bps.

A so-called 1200-baud modem, on the other hand, sends only 600 signals in a second's time, which means that it's working at 600 baud. There are four possible frequencies; they represent the bit-pairs 00, 01, 10, and 11. Each of the 600 tones carries two bits of information (a total of 1200 bits per second).

If you want to nitpick, a modem that's set for 1200 bits per second is really operating at 600 baud. In common use, however, the two terms are used interchangeably. When you see an ad for a 1200-baud modem, it's really a 1200-bps modem.

Mystery Pause

I've written a type of database program for the 64 in BASIC, and I'm having a strange problem. The program sometimes freezes up for some amount of time, then continues normally, then freezes up again. I think it might be due to the two-dimensional arrays. I've also noticed that the more memory used by variables, the longer the freeze-up intervals. Could you please give a solution, or at least an explanation?

Troy Pladson

Don't blame the arrays for the pause. The freezing up of your program is most likely due to the process called garbage collection. *The length of the pause is related to the number of string variables you're using, regardless of whether they're in arrays or not.*

String variables have two parts, the descriptor and the string of characters. The descriptor consists of five bytes: two for the variable name, one for the length, and two for a pointer to the actual string.

Strings can be static or dynamic. If your program assigns a string directly, as in A$="THIS IS A STRING" or by reading DATA statements, the descriptor creates a pointer to memory inside the BASIC program (a static string). If you get the string variable from a disk file, or do some sort of manipulation—with MID$ or the plus sign, for example—the string is stored high in memory (a dynamic string).

If a dynamic string variable changes, the old string remains in memory. The new string is put into the next available memory location and the descriptor is updated to point to the new string. The old string is considered "garbage" because no descriptor points to it. The following program for the 64, which uses a typical GET loop, demonstrates how garbage is generated:

```
10 GETA$:IFA$=""THEN10
20 B$=B$+A$
30 IF A$<>"A"THEN10
40 FORJ=40940TO40959:PRINTCHR$
   (PEEK(J));:NEXT
```

Type in the word ZEBRA *(the program accepts characters until you type an* A*). The final line PEEKs into the memory used by dynamic strings and should print out the characters* ZEBRAAZEBRRZEBBZEEZZ. *The first six characters are* ZEBRA *and* A*, the current values for B$ and A$. The rest* (ZEBR, R, ZEB, B, ZE, E, Z, *and* Z) *are the old values for variables. They're the garbage strings.*

If your program does a lot of work with strings, the computer will eventually run out of available memory for new strings. At that point, BASIC's garbage collection routine takes over. It moves all of the live strings to the top of memory, which takes some time. In the worst case, garbage collection on the 64 can take over an hour. (If you have a September 1986 issue, see the "Horizons" column for an example.)

There are various programming techniques for putting off garbage collection, but they just delay the problem somewhat

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The next question is: "Which modem is best for me?" Let us first say that almost all modems (and services) are set up to communicate in one of three speeds; 300, 1200 and 2400 Baud. If you look around you will find that there is a flood of 300 baud modems on the market and sometimes at very low prices. The reason is simple, they are being dumped because most computer users prefer 1200 Baud. (1200 Baud is about 4 times as fast which means you spend about ¼ the time and money getting the data you want and more time enjoying it.)

You may also be wondering about getting a 2400 Baud modem. 2400's are great (and quite expensive), only if you have a dedicated, data-grade phone line. Here's why. The regular phone system doesn't have the signal clarity and bandwidth to support more than about 1200 baud and as a result, 2400 Baud modems will usually run at either 1200 or, on a real bad line, 300 Baud. They adapt to the worst-case line conditions and will slow transmission accordingly. Why buy a 2400 Baud modem for a lot more money when it's going to transmit at 1200 Baud most of the time anyway? (Kind of like buying a sports car then always running at lower speed).

You will also notice a few very cheap 1200s on the market at "too good to be true prices". They are. The reason is that they are either not truly Hayes and/or Commodore 1670 compatible therefore not usable in all situations and with all services. The Aprotek Minimodem-C™ is both Hayes and Commodore 1670 compatible and 1200 baud. Why not get a modem that will satisfy your present AND future needs by going directly to an inexpensive Aprotek Minimodem-C™ especially when we have it on sale?

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Version D. $59.95 One Supercard and one cable. For two 1571s.

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- Auto Boot Maker (1541, 1571, 1581)
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- I/O Save
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- Variable Cross Ref.
- Quick Scratch

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instead of solving it. The INPUT and INPUT# commands generate less garbage than GET and GET#, for example. You can also force garbage collection to occur by assigning FRE(0) to a variable.

To solve the problem, we'd suggest the program "Sanitation Engineer" from the February 1987 GAZETTE. It reduces garbage collection for a 2000-string array from 316 seconds to about half a second.

Or you could use a 128 in 128 mode. BASIC 7.0 handles strings in a way that keeps garbage collection under five seconds.

ML Hi-Res And Random Numbers

How would I go about turning on and using the bitmap mode from within a machine language program? I know that you put a 1 into the fifth bit of location 53265, but I don't understand how to shift to bit 5 and place a 1 in it. I've tried LSR and ROR. I would also like to know how to generate random numbers with machine language.

Joe Rykowski

Bit 5 of memory location 53265 controls the status of bitmap (hi-res) mode on the 64. To turn on bit 5 from BASIC, POKE 53265, PEEK(53265) OR 215. In machine language, the technique is the same (note that 215 is 32):

```
LDA 53265
ORA #32
STA 53265
```

The following routine turns on the high-resolution screen at 24576, the screen used by DOODLE! pictures:

```
LDA 56578   ;prepares computer
ORA #3      ;for input
STA 56578
LDA 56576   ;tells the VIC to pay
AND #252    ;attention to bank 1
ORA #2
STA 56576
LDA 53272   ;tells where to look
AND #15     ;for bitmap & color
ORA #120    ;memory
STA 53272
LDA 53265   ;finally sets bit 5
ORA #32     ;of 53265
STA 53265
RTS
```

To turn off the bit map, use this routine:

```
LDA 56578
ORA #3
STA 56578
LDA 56576
AND #252
ORA #3
STA 56576
LDA #21
STA 53272
LDA #27
STA 53265
RTS
```

Random numbers are easily generated in machine language. Use the following subroutine:

```
LDA #128
STA 54286   ;low frequency byte
STA 54287   ;high frequency
STA 54290   ;turn on noise
LDA 54299   ;read oscillator 3
RTS
```

First you set voice 3 of the SID chip to a medium or high frequency. Then select the noise generator without gating the register on, so you won't have to listen to the noise. When you JSR to this subroutine, you will return with a random number between 0 and 255 in the accumulator. You only need to use this subroutine once to start the noise generator. Thereafter, any time you want a random number, LDA 54299 to get it. ■

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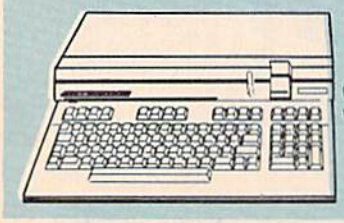

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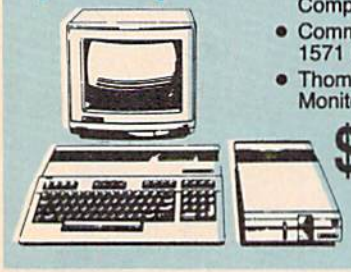

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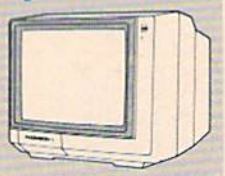

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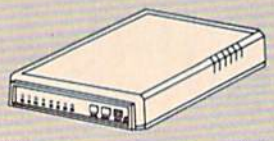

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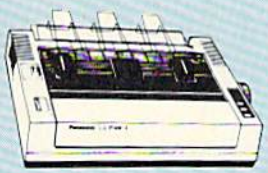

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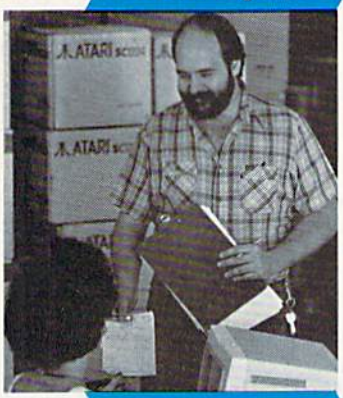

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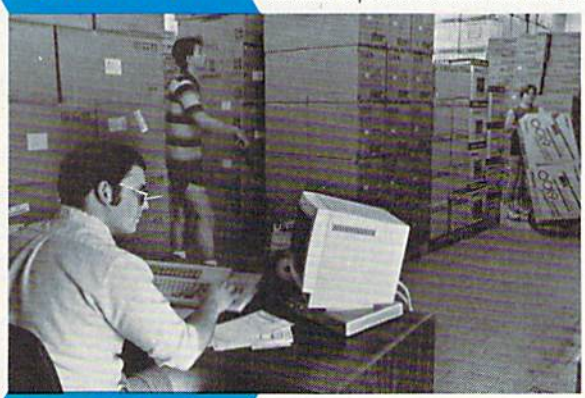

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the geos column

geoPublish: A Close Look

Randy Thompson, Assistant Editor

If you think there's something different about the GEOS column this month, you're right: This entire page was formatted using a Commodore 64 and Berkeley Softworks' geoPublish.

Many of today's magazines are created entirely using personal computers and desktop publishing software. I worked for such a publication for almost a year, so when I received Berkeley Softworks' (BSW's) geoPublish, I was eager to see what could be done on the 64. The results were quite pleasing. Judge for yourself; for the layout and printing of this month's GEOS column, we used a Commodore 64 and geoPublish--BSW's latest entry in the fast-growing desktop publishing market.

Tools Of The Trade

To be honest, this page is the result of several hardware and software tools. For instance, the text is from geoWrite 2.1, and geoPublish is responsible for generating the simple graphics and getting all the text into place.

Hardware-wise, this page was produced using a Commodore 64, one 1541 disk drive, a 1764 RAM exansion unit used as a ramdisk, a 1531 mouse, and an HP Laserjet laser printer. With the exception of print quality and production time, however, this page may just as well have been created using a single-drive 64 armed with a joystick and dot-matrix printer.

Ease Of Use

I certainly wouldn't call this program intuitive. Unlike most GEOS applications, you really have to read the geoPublish manual to use the program. Fortunately, the documentation is well written and includes several helpful appendices.

By the way, the manual that accompanies geoPublish is about 1/2-inch thick. That's almost twice as thick as the booklet that comes with the GEOS system disk.

Setting up the program and getting started is probably the most difficult task. Because geoPublish is approximately 99K in size, it's hard to get the right combination of fonts, text files, and pictures to fit onto a single work disk.

Getting It Down On Paper

Laying out a geoPublish document consists of several steps. First you must generate some text using geoWrite--geoPublish requires text to be in this format. Using the Text Grabber program that comes with geoPublish, however, you can convert most word processor files into geoWrite format.

Graphics must be generated by geoPaint and saved as a photo scrap. You may incorporate several photo scraps by using the Photo Manager desk accessory.

Next, you use geoPublish to create your master page(s). A master page defines the graphics and text that appear on every page in your document. In this case, the master page contains the thick horizontal line and column title appearing at the top of the page, along with the thin vertical lines separating each column of text. You may have up to two master pages: one for lefthand pages and one for righthand pages.

In Layout mode, you import text and graphics and place them onto the page. This page, for example, contains three columns of text, but no imported graphics. Each column of text is linked, so if I reduce the size of the left-most column, geoPublish will automatically flow the lost text into the next two columns.

Also, use Layout mode to edit text that's been placed into a document. Just choose a text block, select the Editor option from the Mode menu and presto--a modified version of geoWrite appears with your text loaded and ready to edit. This mutated version of geoWrite contains most of the features available in geoWrite 2.0.

To create graphics and short headlines--such as the title placed in the upper right corner of this page--use Page Graphics mode. This mode is identical to Master Page mode, except that the graphics and text produced here are attached only to the page you're currently working on. Page Graphics mode offers many useful drawing tools: With options such as Line, Box, Circle, and Spline, geoPublish rivals many commercial drawing programs.

Problems

Page Graphics mode allows you to print text in any font using any point size between 4 and 192. This sounds great, but in actual use, the results can be downright ugly (see the column title above). If you don't use a point size that's directly supported by the desired font, the program fakes it, approximating what the font would look like in the chosen size. Unfortunately, geoPublish doesn't tell you which point sizes each font supports.

To make things easier, geoPublish provides a ruler that runs along the left edge and top edge of the current page. However, the ruler measures in inches only, not points. This is unfortunate because printed material is almost always measured in points.

Power To The 64

Overall, geoPublish is a powerful program, offering most of the features found in desktop publishing software for the Apple Macintosh--the undisputed king of the desktop publishing realm.

Expanding the GEOS universe, geoPublish brings the power of desktop publishing to the 64.

YOU WRITE THE PROGRAM, WE'LL WRITE THE CHECKS.

The GEOS Programming Contest.

So you can code circles around the pros, eh? Well, here's your chance to prove it. It's the GEOS Programming Contest. And all it takes to win is a Commodore and your skill at programming under GEOS to win in any four categories and walk away with all kinds of prizes.

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Just send us the GEOS-based program you're most proud of—on disk—by August 31, 1988. There are four categories, each with a Applications[1] and Desk Accessories[2] winner. Which means that there are eight first prizes. Eight second prizes. And eight thirds.

And each prize consists of lots more prizes.

We may not be the only ones writing checks.

And that's only where the bucks start. Because if your program makes it into a GEOS Shareware Library, all kinds of satisfied users may be writing you checks.

So boot up and get down to pumping out your most professional GEOS program. Then send it in with the information required below. Who knows? We could be sending a check right back to you.

1. Applications are defined as programs which are more complex in nature, are identified by the GEOS Application File Type, are entered from and exit to the deskTop and generate their own unique data file output.
2. Desk Accessories are defined as programs which are less complex than applications, are identified by the GEOS Desk Accessory File Type, may be entered and pop-up within any application and upon exiting return the application to its prior state.

Categories

ENTERTAINMENT—Includes entertainment and games. For example, a "Scrabble-like" game (Application Division) or a dice game (Desk Accessories Division).

EDUCATION—Primarily educational and instructional. For example, a world geography program (Applications Division) or a flash card program (Desk Accessories Division).

PRODUCTIVITY—Designs that improve personal productivity. Examples include an "outline processor" (Applications Division) or a scientific or financial calculator (Desk Accessories Division).

OPEN PROGRAMMING—Open design category that includes programs not covered in other categories. Examples include disk utilities, printer and input drivers and telecommunications programs.

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Official Rules

1. Employees of Berkeley Softworks, Quantum Computer Services, Laser Direct, Compute!'s Gazette Magazine, their advertising and promotional agencies and their immediate families are not eligible to enter the contest.
2. Each entry must be your original work, previously unpublished in any form. All those programs accepted will be required to affirm this in writing.
3. Contestants may enter multiple categories, but may only submit one entry per category per division (e.g. one entry in the Entertainment category Applications Division, *and* one entry in the Entertainment Desk Accessories Division). Regardless of the number of categories you enter, you will only be eligible to win one prize.
4. Deadline for entries is August 31, 1988. Mail entries to Compute!'s Gazette, P.O. Box 5406, Greensboro, NC, 27403 Attn: GEOS Programming Contest.
5. Acceptance of an entry shall not create any implication that the entry has been received and reviewed by Berkeley Softworks or has been used in any way in product development.
6. Judging will be performed by the staff of Compute!'s Gazette Magazine. The decisions of the judges are final in all respects. This includes decisions regarding creativity, similarity among entries and general suitability.
7. Entries become the property of Berkeley Softworks, which reserves the right to adapt, use or publish all entries received. Entries may become part of a "shareware" library to be distributed by Berkeley Softworks, Compute!'s Gazette and Quantum Computer Services. As part of each submission, contestants should include *in* the program their name, address and a "user fee" amount for satisfied users to send a discretionary payment.
8. Entries may be written in any programming language but must be a GEOS based program supporting the GEOS file structure and be executable from the GEOS deskTop or a GEOS application. Whichever language is chosen, the code must be a self-standing program that can be run by someone who does not own the language. We must be able to legally distribute the program without incurring licensing fees or any other obligations to the maker of the language.
9. Entries must be submitted on 5.25" floppy disks in 1541/1571 format. The following should be clearly marked on both the printout and the disk:
   A. Contestant's name, address and phone number.
   B. Category and division for the entry.
   C. Intended use for the program.
10. Entries must be accompanied by a description which explains how to use the program and what it does.
11. This contest is void where prohibited by law. All federal, state and local taxes are the sole responsibility of the winners.

General Conditions

- Entries will be judged on creativity, originality, interface consistency with other GEOS programs and error-free quality of the code.
- Make sure your mailer will protect your disk from damage. Affix sufficient first class postage. Mail your printout, disk and official entry blank to the above address in time to reach Compute!'s Gazette Magazine before the August 31, 1988, deadline.
- Winners will be announced by October, 1988.

Sponsored by Berkeley Softworks and Compute!'s Gazette.

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EVERY CONTEST ENTRY MUST INCLUDE THIS SIGNED FORM:

I warrant that the program presently entitled is my own original work and that the work has not been submitted for consideration elsewhere, nor has it been previously published in any form. If my work is accepted by you, I understand that your decision as to the selection of winners and awarding of prizes is final and without recourse on my part. I understand that by entering this contest, my entry becomes the property of Berkeley Softworks and in the event my program is included in a shareware library, I will be required to sign a standard release agreement. (If you are under 18, your parent or legal guardian must sign for you.)

Signature _____

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BASIC for beginners

Number Drills

Larry Cotton

Over the last couple months, we've learned how to use BASIC's RND function to simulate tossing coins and rolling dice. We even used it to create simple multiplication drill problems.

This month we'll begin a more complete and practical math drill program which covers addition, subtraction, multiplication, and division. It will even be able to accommodate any level of difficulty you wish.

In the process, we'll review many of the BASIC commands we've already learned, and we'll also find a few new uses for RND.

But first, let's consider a few questions left over from last month: why a statement like Q=RND(−TI) is necessary to generate different random numbers each time a program is run, how one string can be less than or greater than another, and why we asked for string instead of numeric input.

How RND Works

To answer the first question as simply as possible, computers generate random numbers by starting with a *seed* number and then performing certain mathematical operations on it to get a new number. Afterward, each random number is used as the seed for the next number.

Commodore computers generate random numbers in three ways, each one causing a different seed to be used. Enter and run this BASIC program which will generate random numbers from 0 to 1:

```
10 X=1
20 PRINT RND(X):GOTO20
```

The value in parentheses determines the seed which creates the random number. When X is any positive number, the initial seed is the same each time the computer is switched on, and the same sequence of random numbers will result. This is rarely useful.

Now change line 10 as follows and run the program again.

```
10 X=0
```

When X is zero, RND gets its seed values from a timer (or clock) which is built into the computer. Those values are constantly changing, so new ones will be generated each time the computer is turned on. Unfortunately, certain values never appear in the seed, so this method is less successful than it should be.

Change line 10 by assigning X any negative value, and run the program once more.

```
10 X=-1
```

A negative value for X will give you—surprisingly—a predetermined, nonrandom number. Programs which use RND can be debugged by setting up the seed with RND(−X), then using RND(X) to generate a series of predictable numbers.

Fortunately, there is a way to generate truly random numbers (or at least numbers which behave very much the way mathematicians expect random numbers to behave). The method is a combination of the above techniques: Use a value from the computer's internal clock, but make it negative.

One of the computer's internal timers constantly counts in sixtieths of a second from the time you turn on the computer until you turn it off. You can see the increasing values in that timer by entering and running this one-line program (type NEW first):

```
10 PRINT TI:GOTO10
```

TI is a BASIC function which we'll cover later. (Note that TI is a reserved BASIC keyword—you should never try to use it as a variable.) TI's value varies according to how long the computer has been on, so all we have to do is put TI in the parentheses and make it negative:

```
Q=RND(-TI)
```

In summary, include a line like the one above (using any numeric variable) to initialize the random seed, and then use RND(X), where X is any positive number.

Comparing Strings

The second question—how strings can be compared—is somewhat easier to explain. Look in a reference guide for a table of CHR$ (character string) codes. These are the ASCII values which are built into the computer for every number, letter, and symbol that the computer recognizes.

Note that A's ASCII (or CHR$) code is 65; B's is 66; C's is 67, and so on. (To some extent, ASCII codes are common to all computers, from home computers to supercomputers.) Type NEW, enter, and run this short program:

```
10 A$="LARK"
20 B$="MARK"
30 IF A$<B$ THEN PRINT "LESS"
```

In line 30, the computer compares the ASCII code for the first character in A$ (which is *L*) to the ASCII code for the first character in B$ (which is *M*).

Since 76 is less than 77, the entire string A$ is deemed to be less than B$ and the word LESS is printed. Now change line 20:

```
20 B$="LARK"
```

The ASCII codes in the first positions are equal, so the computer moves on and compares the second letter in each of the words. These letters are also equal, so the computer compares the letters in the third position. Since all the letters are the same in both words, the IF will fail and the word LESS will not get printed.

Now change line 10:

```
10 A$="LARD"
```

You just made the fourth ASCII code in A$ less than the fourth ASCII code in B$, so A$ will again be less than B$.

Since string comparisons work on a character by character basis, string comparisons can be used to alphabetize words. Change lines 10 and 20 again:

```
10 A$="MMXY"
20 B$="MMYX"
```

Although both strings contain the same letters, A$ is less than B$.

Numeric vs. String INPUT

The last question asks why we used string input in a math program. Here are the relevant lines from last month's program:

```
110 PRINT:PRINT M "X" N "= ";
120 INPUT ANSWER$
130 IF ANSWER$ > "9" OR ANSWER
   $ < "0" THEN PRINT "{3 UP}"
   :GOTO110
140 IF ANSWER$ = "" GOTO300
```

Line 120 could have been:

```
120 INPUT AN
```

But in order to eliminate unwanted answers, line 130 would have to be:

```
130 IF AN < 0 OR AN > 9 THEN P
   RINT "{3 UP}":GOTO 110
```

Line 140 sent the program to the routine starting at line 300, which printed the score if only the RETURN key was pressed. How could this have been done using numeric input?

```
140 IF AN = 0 THEN 300
```

This won't always work, because sometimes the answer to a problem is 0. In those cases, the program would jump to the print-score routine. This is a sloppy technique for exiting a program.

And if anything other than numbers were typed in, the user would encounter the arcane message REDO FROM START. Again, poor technique.

Summary: The safest way to gather user input of more than one character is INPUT ANSWER$ (or whatever string variable you choose). Then, if you need numbers, use the VAL function to convert the string to a number.

A Math Drill Program

A complete math drill program should be able to generate problems which use all four basic math functions: addition, subtraction, multiplication, and division. The user should also be able to choose which multiplication or division table he or she wants to be drilled in. Other features could be a color-coded association with right and wrong answers and the option to vary the skill level.

Let's start with a white border, blue background, and white printing:

```
10 POKE53280,1:POKE53281,6
15 POKE646,1:REM POKE 241,1 FO
   R THE 128
```

Now clear the screen:

```
20 PRINT "{CLR}"
```

Just to make the program more personalized, let's see who's using the program:

```
30 INPUT "WHAT'S YOUR FIRST NA
   ME";N$
```

We want *some* response, so add this line:

```
40 IF N$="" THEN 20
```

If the user doesn't enter a name, this sends control back to the line where the screen is cleared and the message is reprinted. Once the user has entered a name, we want to print the name and the words "Math Practice" on the screen. It would be nice if it were all centered horizontally.

To center a line, we can use the TAB function to print the heading a certain amount from the left screen margin. However, that amount will vary according to length of the name that's typed in. Enter this line, which uses the length of N$ to get our TAB value L.

```
50 L=20-((LEN(N$+16)/2)
```

Clear the screen again and move the cursor down four lines:

```
60 PRINT "{CLR}"
70 FOR T=1 TO 4:PRINT:NEXT
```

Now, using L, which we found in line 50, print the headline and move the cursor down one line:

```
80 PRINT TAB(L)"{RVS}"N$"'S MA
   TH PRACTICE{OFF}"
90 PRINT
```

It's time to let the user choose which math operation to practice. Use the TAB function to print the choices in the middle of the screen:

```
100 PRINT TAB(13)"1. ADD"
110 PRINT TAB(13)"2. SUBTRACT"
120 PRINT TAB(13)"3. MULTIPLY"
130 PRINT TAB(13)"4. DIVIDE"
140 PRINT TAB(12)"WHICH NUMBER
   ?"
```

Since we want only one of four responses, use a GET statement:

```
150 GET A$:IF A$ < "1" OR A$ >
    "4" THEN 150
```

We'll finish up next month. If you've been typing in these program lines, save them at this stage on disk or tape with the name you have chosen.

It's possible (and is a good idea) to run this program even though it's not finished. When you write a program, it's a good idea to test as much of each phase as often as possible. Sometimes testing a phase will require you to write extra code which will be removed as the remainder of the program is written. At other times, the phase can be tested without extra support code. In any case, testing each phase of a program as it is completed can save you a lot of headaches further down the line. It's a lot easier to test and debug part of a program than it is a whole program.

Here's a challenge for ambitious beginners: Try to finish the program yourself. Then compare your version to the one in next month's column.

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machine language programming

Jim Butterfield
Contributing Editor

Handling disk or tape data files requires two levels of programming. On the first level, you must open the file before starting and close it when you are finished. These actions usually take place just once. On the second level, you must "connect" with the file and then read or write the desired data. This happens many times during a program: We connect with the file as needed and disconnect from it to perform other tasks.

Whenever possible, I like to open and close files in BASIC. It's easier that way. Since these commands are used only once, opening and closing files in BASIC doesn't really slow down the program.

I convert the actual data handling—connecting, reading, writing, and disconnecting—to machine language for speed. BASIC's GET# statement is slow and clumsy. The INPUT# command is faster, but suffers from a number of restrictions: You can't input commas, colons, or CHR$(0)'s, and you're limited to a maximum input of 80 characters. So I use machine language for smooth, fast file handling.

An Example Program

Let's write a short program that reads sequential disk files. The program will send its output to the screen, but in such a way that you easily can redirect it to a printer or even to another file.

Using BASIC, we'll open the input file as file 1 and open the output file as file 2. All the machine language program needs to know is that it's receiving data from file 1 and sending it to file 2. Assuming that we have already written the BASIC portion of our program, let's plan the machine language section.

First, our machine language program connects file 1 as the current source of input. We do this with

```
LDX  #$01     ;File 1
JSR  CHKIN    ;Setup file 1 for input
```

CHKIN is a kernal routine accessed through the vector located at $FFC6. This routine defines the logical file number found in register X as the current source of input (the current input channel). Now that we've connected our input file, we can get a character with the code

```
JSR  GETIN    ;Get a character
```

The vector located at $FFE4 points to the kernal routine GETIN. Like BASIC's GET command, GETIN inputs one character. In this case, the character received is placed safely into register A (perhaps not that safe, but we'll pick up on that in a moment).

End Of File?

Let's plan ahead: Later, our program will need to check whether it has reached the end of the input file. As in BASIC, we'll check the system's status variable ST. But the program can't wait too long, or the status may change due to some other activity, such as the output of our character to the screen. So we'll read ST now and use it later.

ST is found at address $90 (decimal 144) on the 64, 128, Plus/4, 16, and VIC-20. It can be found at $96 on earlier Commodore machines. To read and save the current file status, we use the code

```
LDX  $90      ;Read file status
PHP           ;Save status on stack
```

Whenever you load a value into a register, certain flags are set in the computer's status register. (Do not confuse the processor's status register with the ST variable located at $90.) In the LDX instruction above, the status register's zero flag is set if location $90 contains a value of 0. To save the current zero-or-nonzero status of location $90, we PHP (PusH Processor status) to store the flag on the stack until we need it.

Sending Output

Now that we have a character, we need to output it to the screen—or more accurately, output it to file 2. Before we can output the character, however, we have to disconnect the input channel using the kernal subroutine CLRCHN, located at $FFCC. (Don't ask why. Eight-bit Commodore computers just seem to require it.)

When calling the disconnect routine, we must be careful. Calling CLRCHN destroys the contents of register A. In order not to lose the character in register A, we push it onto the stack.

```
PHA           ;Save character
JSR  CLRCHN   ;Disconnect input
               channel
```

The stack now contains two things: the character we've just received and the processor status. When we start to pull things off the stack, the first thing we will get is the last thing we put there—in other words, the character.

Output is straightforward. We connect to the output file, retrieve the character from the stack, send the character to the screen, and clear the output channel:

```
LDX  #2       ;File 2
JSR  CHKOUT   ;Setup file 2 for output
PLA           ;Retrieve character
JSR  CHROUT   ;Output character
JSR  CLRCHN   ;Disconnect output
               channel
```

Two more kernal routines are used here: CHKOUT, pointed to by $FFC9, defines an output channel; and CHROUT, pointed to by $FFD2, outputs the character in register A.

Is there more data available to be read from the input channel? To check, we use the following code:

```
PLP           ;Get status
BEQ  START    ;Branch if not end of file
RTS           ;Return to BASIC
```

Using PLP, we bring back the earlier status of ST from the stack. If the zero flag is set, we go back to

the start of our subroutine. If the status is not zero, we're finished, and we can return to BASIC.

Here's the final program:

```
100 DATA 162,1{6 SPACES}:REM LDX #1
110 DATA 32,198,255 :REM JSR CHKIN
120 DATA 32,228,255 :REM JSR GETIN
130 DATA 166,144{4 SPACES}:REM LDX $90
140 DATA 8{10 SPACES}:REM PHP
150 DATA 72{9 SPACES}:REM PHA
160 DATA 32,204,255 :REM JSR CLRCHN
170 DATA 162,2{6 SPACES}:REM LDX #2
180 DATA 32,201,255 :REM JSR CHKOUT
190 DATA 104{8 SPACES}:REM PLA
200 DATA 32,210,255 :REM JSR CHROUT
210 DATA 32,204,255 :REM JSR CLRCHN
220 DATA 40{9 SPACES}:REM PLP
230 DATA 240,226{4 SPACES}:REM BEQ START
240 DATA 96{9 SPACES}:REM RTS
250 A=828:REM USE A=2304 IN 128 MODE
260 FOR J=A TO A+30
270 READ X
280 T=T+X
290 POKE J,X
300 NEXT J
310 IF T<>4390 THEN STOP
320 INPUT "FILENAME";F$
330 IF F$="" THEN STOP
340 OPEN 1,8,4,F$
350 OPEN 2,3
360 SYS A
370 CLOSE 1
380 CLOSE 2
```

When run, the program prompts you for a filename of a sequential text file. If the file is on the disk in drive 8, it is listed to the screen. To make this routine work with tape, change the 8 in line 340 to a 1. If you wish to send the file's output to the printer, simply change the 3 in line 350 to a 4.

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Faster And Faster

Todd Heimarck
Contributing Editor

Have you ever seen a program that works just fine, but it's so slow that instead of running, it walks? This month, we'll look at ways to improve the speed of BASIC programs.

The slowest program I ever wrote was designed to alphabetize a mini-database file of more than 1200 records of 25 bytes each (about 30K). It ran on a VIC-20 with an 8K expander and a Datassette. Since the available memory was insufficient to hold all of the data, it was necessary to split the file into chunks of about 50–100 records. To alphabetize, the program read through every file on tape, looking for names that began with the letters *A*–*C*. After alphabetizing, it wrote out new files called *A*, *B*, and *C*. Then, the user would have to rewind the tape and the program would search for names in the *D*–*F* range, alphabetize them, and so on. The program finished after about 12 hours and numerous tape-swaps. When it was converted to run on the 64 with a disk drive, the program ran much faster.

The Big Picture

Sometimes you can speed up a program by sitting back and redefining the goal. For example, let's say you're running some sort of single-elimination sports tournament (with no ties or draws). Once a player loses, he or she is out. If there are 111 entrants, how many games will be played? You could figure this way: 111 players means 55 games (one bye) for round one; 28 games for round two; then, 14, 7, 3 (one bye), 2, and 1. It would be easy to write a short loop that continually divides by two.

Now look at the problem from a different perspective. If you begin with 111 players and end with one champion, there must be 110 losers, each of whom loses exactly one game. Thus, the answer is 110 losers, 110 games. For any number of players X, the number of games in a single-elimination tournament is X−1. This solution is simpler, faster, and more elegant than the brute force loop. Looking at the big picture isn't a programming technique; it's a problem-solving technique.

Eliminating Bottlenecks

A second way to speed up programs is to identify and eliminate bottlenecks. The three major problem areas with the alphabetizing program mentioned above were: first, lack of memory; second, the slow speed (and lack of random access) of the tape drive; and third, the slow bubble sort algorithm.

Moving the program to a Commodore 64 solved the memory problem—all of the variables could fit into memory at the same time. Transferring the data from tape to disk eliminated the second problem. In these cases, the speed up was a result of faster equipment.

The primary flaw of bubble sorts is that when you double the size of the list to be alphabetized, you quadruple the time it takes to sort the list. Bubble sorts are relatively easy to program, but they're awfully slow. Switching over to a quick sort or a Shell sort would give much better results. This is one example of a bottleneck that can be fixed by a better algorithm.

Tweaking And Tricks

As programmers progress from beginners to accomplished virtuosos, they learn various useful tidbits and morsels. Techniques for making programs run faster can sometimes be found, among other places, in the "Hints & Tips" column. There isn't space in this column to list dozens of tips, but here's one example. Run the following program (it works on any eight-bit Commodore computer):

```
EG 10 TI$="000000"
GJ 20 FORJ=1TO1000:K=555/32:NE
      XT
PP 30 T=TI:PRINT T/60 "SECONDS
      "
```

Line 10 resets the jiffy clock. Line 20 divides 32 into 555, repeating the loop 1000 times. Line 30 prints out the time, which on a 128 in 64 mode was 9.5 seconds.

Change line 20 slightly:

```
EG 10 TI$="000000"
XS 20 FORJ=1TO1000:K=555.0/32.
      0:NEXT
PP 30 T=TI:PRINT T/60 "SECONDS
      "
```

Now, we're dividing 555.0/32.0 instead of 555/32. The calculation is the same, but the time has jumped up to 15.7 seconds.

Finally, add line 15 and change 20 again:

```
EG 10 TI$="000000"
RP 15 L=555:M=32
SK 20 FORJ=1TO1000:K=L/M:NEXT
PP 30 T=TI:PRINT T/60 "SECONDS
      "
```

Note that variables L and M have been defined as 555 and 32, and the calculation is L/M. In this case, the time is cut to only 5.2 seconds, almost twice as fast as the first program and three times faster than the second.

When you ask BASIC to calculate 555/32, it has to analyze the characters in the line to figure out which numbers are in the ones, tens, and hundreds places, and so on. The ASCII characters are then translated into a floating-point representation of the number, which enables the computer to make the calculation. If the numbers 555 and 32 are inside the FOR-NEXT loop, BASIC has to make this translation 1000 times. If you put the numbers into variables outside the loop, the translation occurs only once. By understanding a little about how BASIC handles its tasks, you can cut seconds (or minutes) from a program's running time.

Barry L. Camp

Speed up BASIC with this short utility that adds a dynamic new dimension to the POKE command. For the Commodore 64, 128, Plus/4, and 16.

Many programs use BASIC's POKE command. Since it lets you alter any byte of your computer's memory, it's a handy command that makes up for most of the commands that the designers left out of BASIC. POKE is often used to control graphics and sound effects. In addition, POKE can be used to place machine language programs into memory, which are then started with the SYS command.

The POKE command can affect only one byte at a time, however, so it is slow. A FOR/NEXT loop that POKEs a large machine language program into memory can take a long time to execute.

"Power POKE" alters the syntax of the POKE command to make it more versatile. The new syntax is

```
POKE addr,byte [,byte,byte, ... byte]
```

The standard syntax still works for POKE statements, but Power POKE allows *additional* values to follow the first two. These values are POKEd into successive locations, one right after another. For example, these two lines:

```
10 FOR X=1024 TO 1029: READ Y: POKE X,Y: NEXT
20 DATA 72,69,76,76,79,33
```

can be simplified to just one with Power POKE:

```
10 POKE 1024,72,69,76,76,79,33
```

As you can see, Power POKE eliminates the need for nearly all of the code associated with BASIC loaders (such as FOR/NEXT and READ), making your programs more efficient and easier to read.

Typing It In

Power POKE is written in BASIC. Type in the Power POKE loader. Be sure to type in the correct program for your machine. Program 1 is for the 64; Program 2 is for the 128; and Program 3 is for the Plus/4 and 16. After you've finished entering the program, save a copy to tape or disk.

Once installed, Power POKE is in the system to stay. The only practical way to disable it is to shut the computer off. If you write programs that use the special Power POKE syntax, you'll need to install Power POKE before running your programs.

With a little imagination, Power POKE can be used in many different situations. A two-byte memory pointer (vector) can be set up easily, like this:

```
POKE vector address, low byte, high byte
```

A mapping book such as *Mapping the Commodore 64* or *Mapping the Commodore 128* (COMPUTE! Books) should give you other ideas. For instance, you might find Power POKE useful for stuffing the keyboard buffer and setting the sound registers.

See program listings on page 94.

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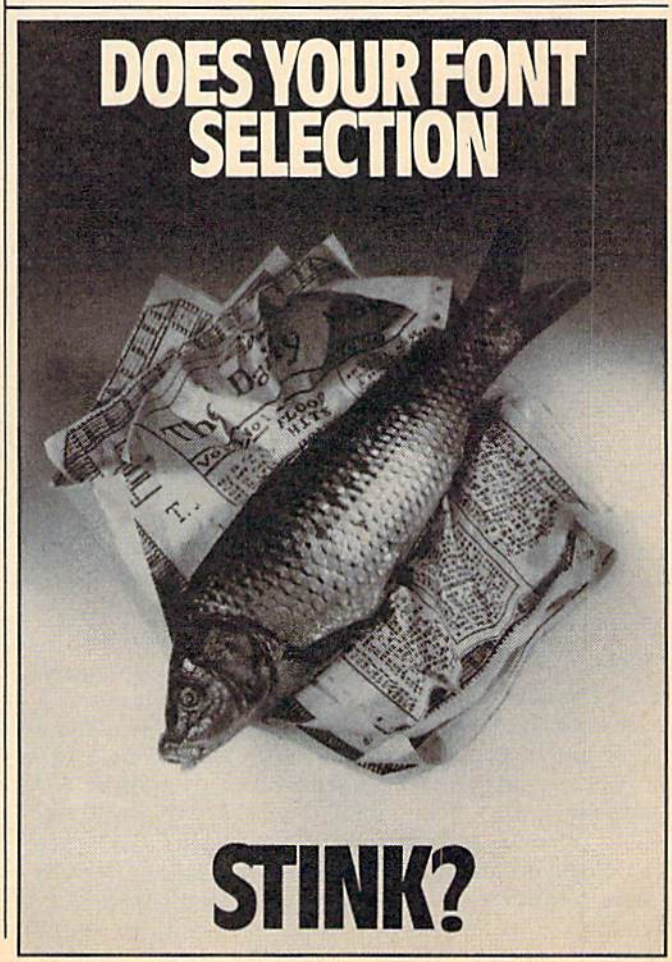

What Type Of Person Likes Computers?

Fred D'Ignazio
Contributing Editor

Why do you like your computer?

John Updike, in his novel, *Roger's Version* (Knopf, 1986), presents the view that computer enthusiasts are "things persons" rather than "people persons."

According to Updike, we computerphiles get our kicks working with machines, plastic models, stamp collections, and other inanimate objects. If we have a choice, we will always choose spending time with some *thing* rather than with another person.

He may be right. Take me, for instance. I'm a writer. Writers are notorious loners. I spend my days cloistered away with my word processor, far from the hubbub of clamoring offices, downtown commuting, and other people. I have chosen to spend my days with a thing (my computer) rather than with other human beings.

How about you? Why do you like computers? Do your reasons reveal the kind of person you are?

Personality Types

Recently I asked a large number of people why they liked computers. Their responses placed them into six general personality categories:

- puzzle solver
- organizer
- escape artist
- teacher
- conversationalist
- toy collector

Puzzle solvers are people who love solving riddles and problems. Computers provide them with an unending supply of new problems and puzzles to solve—for example, how to make software work, how to code a program, how to plug in a new circuit card, how to format a disk, how to recover data that has been lost, and so on.

Organizers are people who can't stand chaos and who want to put their lives in order. They use their computers to file telephone numbers, type their letters, inventory their household goods, create calendars and "To Do" lists, and plan schedules. "A place for everything, and everything in its place." The computer becomes a tireless secretary to the organizer. No job is too tough, no piece of information is too trivial to be captured and filed.

The *escape artist* loves computers because, like romance novels, science-fiction movies, and soap operas, computers offer a means to escape from the humdrum world into a new world of danger, adventure, and intrigue. Escape artists play computer games—text adventures, shoot-'em-ups, and simulators. A computer game is the ultimate flying carpet. It transforms the average guy into a motorcycle racer, a stunt pilot, or a master detective. Unlike other media, the computer personalizes adventures and molds them around the player and his or her secret desires.

Teachers love computers because they see what computers can do for kids. Teachers have witnessed dozens of success stories where a poorly motivated student suddenly catches fire and becomes a better student, all because of a computer. They have watched kids with computers write better, improve their mathematical and problem-solving skills, and become better communicators. They have seen dropouts and special kids use computers as a doorway to peer acceptance and academic success.

The *conversationalist* likes computers because a computer is "someone" to talk to. Conversationalists are incredibly social types. They have a desire to communicate, share their ideas, listen, and respond. They love to interact. The computer is an addiction for conversationalists. Every time it updates the picture on its screen, flashes a new message, or obeys a command, it feeds the conversationalist in subtle but powerful ways. The conversationalist loves to use the computer to reach other people online via bulletin boards, information services, E-mail, and so on. And when other humans are not available, the conversationalist is content to type things into the computer, rejoicing quietly in the computer's prompt reply. For the conversationalist, the computer is always listening.

Last we have the *toy collector.* Toy collectors come in all varieties. There are boat collectors, book collectors, jewelry collectors, money collectors, new-house collectors, experience collectors, and so on. A computer collector is just a high-tech offshoot of the toy collector. Along with his computer collection he may also have several stereos, walkmen, boom boxes, synthesizers, CB radios, VCRs, and video cameras. Anything high-tech, state-of-the-art, will do—just so it's electronic.

From the list above, it's hard to tell if Updike is right. Some of the personalities listed tend to be people persons, others are things persons. So, I repeat, why do *you* like computers? Are you one of the types above, or are you something new? Please write me and let me know. Write to:

Fred D'Ignazio
c/o COMPUTE!'s GAZETTE
324 West Wendover Ave., Suite 200
Greensboro, NC 27408

Key Clicker

John Walker

Enrich your computer with one of three personalities. This unusual and useful program adds three different keyclick sounds to the 64 and 128.

The sound of keyclicks, heard when someone is typing on a keyboard, is a matter of personal taste—some people like them, and some people don't. While keyclicks may annoy some people, they help others type more accurately.

It should be no suprise, then, that some computers have keyclicks and others don't. The Commodore 64 and 128 keyboards don't have keyclicks, but you can add them with "Key Clicker." The three different sounds featured in the program let you choose the click that fits your mood.

Typing It In

If you have a Commodore 64, type in and save Program 1. If you have a 128, type in Program 1 up through line 250, then substitute lines 300–360 (Program 2) before saving the program.

When you're ready to use Key Clicker, load the program and type RUN. You'll be presented with three options: *computer, typewriter,* and *dramatic.* Each time you press a key, the *computer* option makes a high-pitched "boop" sound just like the computers did in 1950's science-fiction movies. The *typewriter* option makes your computer sound like a manual typewriter. Finally, the *dramatic* option is similar to the typewriter option, but each press of the RETURN key sounds a deep "boom."

Type in the option of your choice, and Key Clicker will be activated. The program will continue to work until the machine is reset, or until some other program uses the SID sound chip. Note that the 128 version stores the machine language routine in the tape buffer; tape operations will write over it.

See program listings on page 87.

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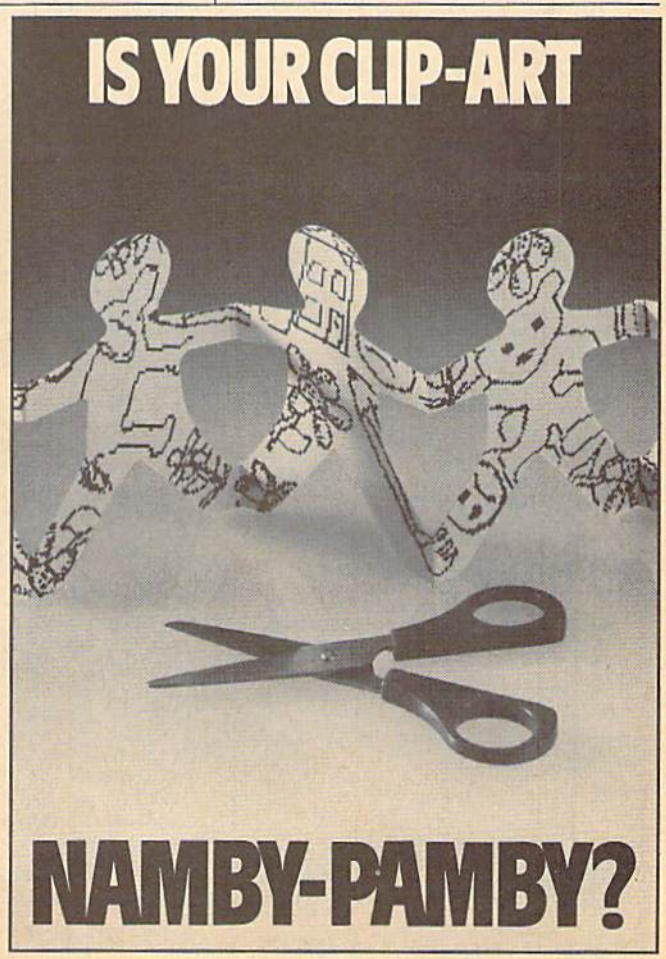

• Several readers have had trouble typing in "Mosaic" (February). The line following line 370 should be 380, not line 30. The corrected line, including checksum, should be

```
SS 380 POKE198,0
```

• In last month's "Bug-Swatter," we noted our suspicion that "Delta War" (January) has a bug. Our suspicions were confirmed. Below is a short machine language routine to correct it. Type in the program below using "MLX" (found elsewhere in this issue). Be sure to save a copy to the disk containing Delta War before exiting MLX. To correct your copy of Delta War, simply type LOAD"*filename*",8,1 then type SYS49152. You will then be prompted for the input filename. Enter the name you used to save Delta War. After the file has been loaded and corrected, you will be prompted for the output filename. This filename must be different from the input filename.

```
STARTING ADDRESS: C000
ENDING ADDRESS:   C1C7

C000:A9 0F A8 A2 08 20 BA FF 8F
C008:A9 00 20 BD FF 20 C0 FF 40
C010:A9 82 85 FB A9 C1 85 FC D3
C018:20 E8 C0 A9 A1 85 FB A9 5B
C020:C1 85 FC 20 E8 C0 20 60 70
C028:A5 A9 C8 85 FD A9 C1 85 F7
C030:FE 20 F5 C0 A9 01 A8 A2 49
C038:08 20 BA FF A9 C8 85 FB 94
C040:A9 C1 85 FC 20 31 C1 A2 73
C048:C8 A0 C1 AD 6B C2 20 BD CD
C050:FF A9 00 20 D5 FF 20 09 36
C058:C1 AD 6A C2 F0 03 4C 1B E6
C060:C0 A2 BF A0 09 A9 02 85 65
C068:FB A9 10 85 FC A9 03 85 C6
C070:FD A9 10 85 FE 20 3C C1 68
C078:A9 10 8D 02 10 A9 9D 8D 94
C080:03 10 A9 AE 85 FB A9 C1 D8
C088:85 FC 20 E8 C0 20 60 A5 8B
C090:A9 19 85 FD A9 C2 85 FE 20
C098:20 F5 C0 A9 01 A2 08 A0 9D
C0A0:00 20 BA FF A9 19 85 FB 3A
C0A8:A9 C2 85 FC 20 31 C1 A2 1C
C0B0:19 A0 C2 AD 6B C2 20 BD 7E
C0B8:FF A9 01 85 FB A9 08 85 39
C0C0:FC A9 FB A2 C0 A0 19 20 AF
C0C8:D8 FF 20 09 C1 AD 6A C2 A7
C0D0:F0 03 4C 82 C0 20 E7 FF 93
C0D8:A9 BC 85 FB A9 C1 85 FC 2B
C0E0:20 E8 C0 A2 80 6C 00 03 A7
C0E8:A0 00 B1 FB F0 06 20 D2 63
C0F0:FF C8 D0 F6 60 A0 00 A9 5D
C0F8:00 85 FB A9 02 85 FC B1 C7
C100:FB 91 FD F0 03 C8 D0 F7 89
C108:60 A2 0F 20 C6 FF 20 CF 8E
C110:FF 0A 0A 0A 0A 8D 6A C2 16
C118:20 CF FF 29 0F 0D 6A C2 76
C120:8D 6A C2 20 CF FF C9 0D 7E
C128:F0 03 4C 23 C1 20 CC FF C8
C130:60 A0 FF C8 B1 FB D0 FB B3
C138:8C 6B C2 60 8E 6C C2 8C 73
C140:6D C2 18 8A 65 FB 85 FB F8
C148:98 65 FC 85 FC 18 8A 65 2C
C150:FD 85 FD 98 65 FE 85 FE AE
C158:A0 00 B1 FB 91 FD C6 FB 30
C160:A5 FB C9 FF D0 02 C6 FC 08
C168:C6 FD A5 FD C9 FF D0 02 55
C170:C6 FE CE 6C C2 D0 E3 CE A7
C178:6D C2 AD 6D C2 C9 FF D0 FD
C180:D9 60 93 0D 12 44 45 4C C4
C188:54 41 20 57 41 52 20 52 E5
C190:45 50 41 49 52 20 50 52 8D
C198:4F 47 52 41 4D 2E 0D 0D 3E
C1A0:00 0D 49 4E 50 55 54 20 16
C1A8:46 49 4C 45 3A 00 0D 4F BA
C1B0:55 54 50 55 54 20 46 49 4C
C1B8:4C 45 3A 00 0D 41 4C 4C 4D
C1C0:20 44 4F 4E 45 21 0D 00 FC
```

• "Sprint II" (January) also fell prey to the MLX lister bug. Type in the program below using MLX and save a copy to the disk containing the corrupted copy of Sprint II. Type LOAD"*filename*",8,1 and then type SYS49152; then follow the prompts as explained above.

```
STARTING ADDRESS: C000
ENDING ADDRESS:   C1DF

C000:A9 0F A8 A2 08 20 BA FF 8F
C008:A9 00 20 BD FF 20 C0 FF 40
C010:A9 96 85 FB A9 C1 85 FC D8
C018:20 FC C0 A9 B5 85 FB A9 01
C020:C1 85 FC 20 FC C0 20 60 11
C028:A5 A9 DC 85 FD A9 C1 85 7A
C030:FE 20 09 C1 A9 01 A8 A2 BB
C038:08 20 BA FF A9 DC 85 FB E4
C040:A9 C1 85 FC 20 45 C1 A2 C3
C048:DC A0 C1 AD 7F C2 20 BD 78
C050:FF A9 00 20 D5 FF 20 1D 4A
C058:C1 AD 7E C2 F0 03 4C 1B 69
C060:C0 A2 94 A0 11 A9 41 85 BE
C068:FB A9 86 85 FC A9 42 85 14
C070:FD A9 86 85 FE 20 50 C1 5F
C078:A9 8B 8D 41 86 A9 A9 8D 33
C080:42 86 A9 4C 8D D2 97 A9 4F
C088:90 8D D3 97 A9 FF 8D D4 E6
C090:97 A9 00 8D D5 97 A9 C2 44
C098:85 FB A9 C1 85 FC 20 FC 8A
C0A0:C0 20 60 A5 A9 2D 85 FD FB
C0A8:A9 C2 85 FE 20 09 C1 A9 A2
C0B0:01 A2 08 A0 00 20 BA FF 5C
C0B8:A9 2D 85 FB A9 C2 85 FC 2B
C0C0:20 45 C1 A2 2D A0 C2 AD 25
C0C8:7F C2 20 BD FF A9 00 85 C6
C0D0:FB A9 80 85 FC A9 FB A2 4C
C0D8:D5 A0 97 20 D8 FF 20 1D 86
C0E0:C1 AD 7E C2 F0 03 4C 96 6D
C0E8:C0 20 E7 FF A9 D0 85 FB 67
C0F0:A9 C1 85 FC 20 FC C0 A2 51
C0F8:80 6C 00 03 A0 00 B1 FB 6A
C100:F0 06 20 D2 FF C8 D0 F6 6A
C108:60 A0 00 A9 00 85 FB A9 36
C110:02 85 FC B1 FB 91 FD F0 C3
C118:03 C8 D0 F7 60 A2 0F 20 B4
C120:C6 FF 20 CF FF 0A 0A 0A 4E
C128:0A 8D 7E C2 20 CF FF 29 79
C130:0F 0D 7E C2 8D 7E C2 20 86
C138:CF FF C9 0D F0 03 4C 37 11
C140:C1 20 CC FF 60 A0 FF C8 94
C148:B1 FB D0 FB 8C 7F C2 60 C5
C150:8E 80 C2 8C 81 C2 18 8A 2E
C158:65 FB 85 FB 98 65 FC 85 D7
C160:FC 18 8A 65 FD 85 FD 98 AA
C168:65 FE 85 FE A0 00 B1 FB 63
C170:91 FD C6 FB A5 FB C9 FF 85
C178:D0 02 C6 FC C6 FD A5 FD 05
C180:C9 FF D0 02 C6 FE CE 80 73
C188:C2 D0 E3 CE 81 C2 AD 81 FE
C190:C2 C9 FF D0 D9 60 93 0D 79
C198:12 53 50 52 49 4E 54 20 75
C1A0:49 49 20 52 45 50 41 49 7B
C1A8:52 20 50 52 4F 47 52 41 0A
C1B0:4D 2E 0D 0D 00 0D 49 4E ED
C1B8:50 55 54 20 46 49 4C 45 7B
C1C0:3A 00 0D 4F 55 54 50 55 E9
C1C8:54 20 46 49 4C 45 3A 00 C7
C1D0:0D 41 4C 4C 20 44 4F 4E 78
C1D8:45 21 0D 00 00 00 00 00 E8
```

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Mirrors

Paul Carlson

Here's a program that produces an ever-changing, lightning-fast kaleidoscopic display in hi-res mode on the 64.

This graphics program creates entrancing, constantly changing designs on the 64's high-resolution screen. Because the program is written entirely in machine language, you must enter it using the "MLX" machine language entry program found elsewhere in this issue. When you run MLX, you are asked for the starting and ending addresses for the data that you'll be entering. Respond with the following values:

Starting address: 0801
Ending address: 0E08

When you've finished typing in the data, be sure to save a copy to disk or tape before leaving MLX. "Mirrors" is loaded and run just like a BASIC program.

A Screen Full Of Mirrors

When run, the program clears the screen and begins to create its display. It's divided into four quadrants; inside each quadrant, a graceful series of lines moves in a continuously changing pattern. Since each quadrant mirrors the others, the result is pleasingly symmetrical. Press any key to terminate the program and return to BASIC.

How It Works

The 64 uses a complicated addressing scheme for bit-mapped graphics. To calculate the address of the memory location that corresponds to the pixel being plotted, you might use the equation

V=BASE+320*INT(Y/8)+8*INT(X/8)+(Y AND 7)

where BASE is the address of the high-resolution screen in memory, and X and Y are the horizontal and vertical coordinates of the pixel. It is very common for programmers to use such an equation to calculate the value of V each time a pixel is plotted. This uses an unnecessary amount of time, however, since it does not make use of the fact that every pixel on a plotted line is adjacent to the previously plotted pixel.

Mirrors uses the above equation only *once* to plot the first pixel on the line. After the first pixel is plotted, only the value of V has to be changed for the remaining pixels. To compute the address of the remaining pixels in a line, the following logic is used:

If X increases, then if (X AND 7)=0, then V=V+8

If X decreases, then if (X AND 7)=7, then V=V-8

If Y increases, then if (Y AND 7)=0, then V=V+313 otherwise V=V+1

If Y decreases, then if (Y AND 7)=7, then V=V-313 otherwise V=V-1

This method of calculating pixel locations is much faster than the conventional method.

See program listing on page 94.

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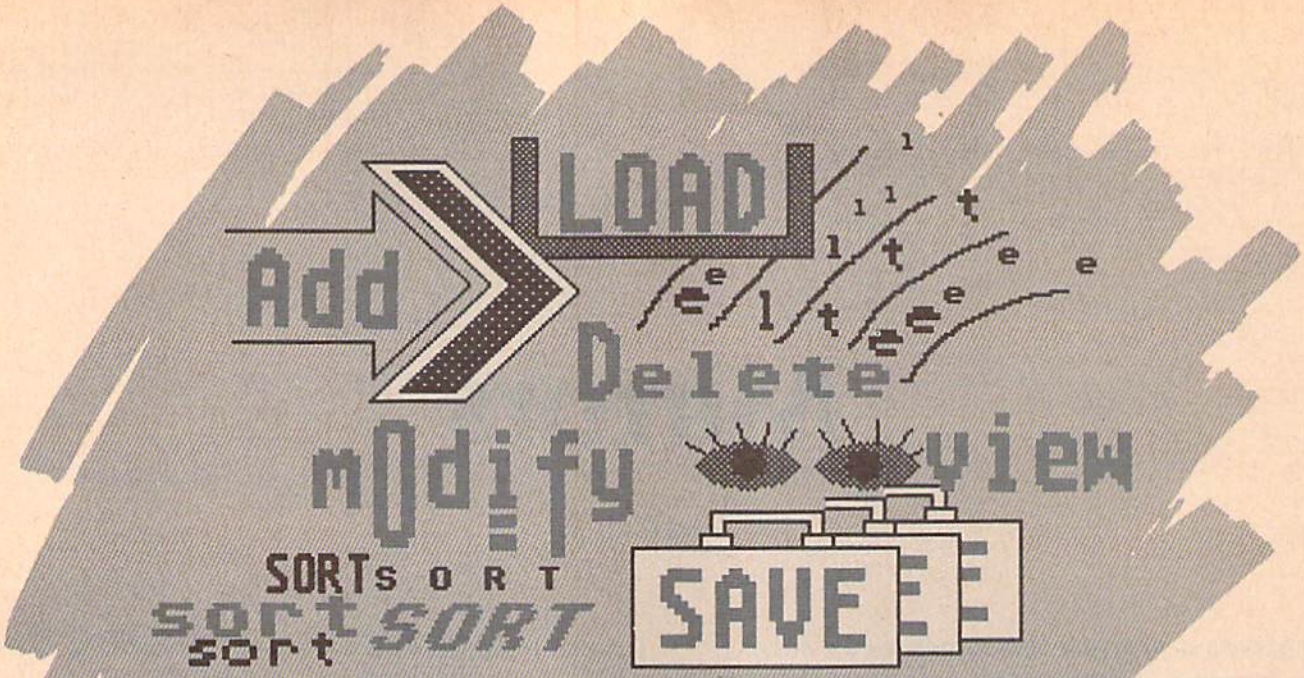

Speed File For The 64

Dave Crook

This powerful, full-featured data-file program is packed with commercial-quality features. With it, you can custom design your own record formats for any type of information you'd like to store. You can add, delete, modify, sort, load, save, and view your data by using easy-to-follow menu commands. And if this isn't enough, you can even generate printed reports and labels in any format you wish. For the 64 with disk drive. A Commodore 1525/MPS-801/803 or compatible printer is recommended.

"Speed File" is a data-file program that allows you to design creative, customized screens for entering and viewing records. It's written in machine language for maximum speed. With Speed File, records can be added, deleted, modified, sorted, saved to disk, or viewed on the screen. And Speed File's printing option lets you custom design printer formats and even print labels. With Speed File, you can organize your stamp collection, VCR tape library, address file, or just about any collection of information you might want to catalog.

Since Speed File is written in machine language, you'll need to enter it with "MLX," the machine language entry program found elsewhere in this issue. When you run MLX, you'll be asked for the starting and ending addresses of the data you'll be entering. Here are the values to use for Speed File

Starting address: 0801
Ending address: 22B8

Follow the MLX instructions carefully, and be sure to save a copy of the Speed File data before leaving MLX. Although written in machine language, Speed File can be loaded and run just like a BASIC program, so to get started, simply load the program and type RUN.

Creating A Format

When you first run Speed File, you'll see the main menu on your screen. From this menu, you can design a file, read a file from disk, write the current file to disk, call the function menu or print menu, sort, quit, or view a disk directory. Understanding the three menus—main, function, and print—is the key to using Speed File. First we'll look at the steps to create a record format, and then we'll examine the commands found in each of the menus.

The first choice on the main menu is *D—Design New File*, and the first time you use Speed File, this is exactly what you'll need to do. So, press D at the main menu to begin the creation process. A nonblinking cursor will appear on the fourth screen line. Note that the bottom screen line and the top three lines are reserved for messages. You can use all the screen lines in between these areas for your screen format. During the designing process, the keyboard is fully active, which gives you maximum flexibility in editing and moving the cursor around the screen but may cause problems if you aren't careful. The screen will scroll if the cursor is moved below the bottom line, or it will clear if you press CLR, so be careful as you design your record format.

Each item in your record will have two parts: a field title—NAME, for example—and a place where field data (each person's name, from the previous example) will go. Field titles, or any other information you desire, may be placed anywhere outside the field areas by simply typing the title you

want. For example, simply type *NAME:* where you'd like NAME to appear on the screen. To define the field information, use the CTRL-9 key combination followed by spaces. These spaces will appear in reverse video. (You can cancel reverse video with CTRL-0.) Be sure to leave enough spaces for the longest item of information you expect that field to hold. If, for example, you expect the longest name in your file to be 20 characters, make the name field 20 characters wide. Although there's no limit on the length of a field, the combined length of all fields cannot exceed 255 characters. There is a limit of 15 fields per record.

When you've finished designing a screen format, press the up-arrow key. The screen will display your creation and prompt you to verify that this is the way you want your screen format to appear. If you're not pleased with the format, press N. Next, decide either to quit or to edit the screen. If you quit (by pressing Q) all the information entered will be erased. If you choose to edit, press E. The cursor will reappear and you can make changes. When you're satisfied with the screen, press Y. Speed File will check your format, and if you haven't exceeded the limit of 15 fields, you'll be prompted for a filename.

Enter a name for the file and press RETURN. This is the last step in designing the file. The main menu will return to the screen, and you'll be ready to start adding records. Now, we'll take a look at each of the main menu's commands.

Main Menu Commands

D. Starts a new file. If there is already a file in memory, you'll get a message that will ask you to choose either to save or to discard the current file. Press S to save the file or D to discard it. In either case, the main menu will return with no apparent action taken. However, if you discard the file, the current filename is no longer displayed on the bottom screen line when the menu returns. You're now free to create another file.

When there's no file in memory, pressing D at the main menu will bring up the screen to design a format.

R. Reads in a file from disk. Enter a filename at the prompt and press RETURN. The disk status will be displayed after the load. When a file is in memory and R is pressed, you'll be asked to save or discard the current file.

W. Writes the current file to disk. Use a filename not already included on the disk. The current filename displayed on the bottom screen line will serve to remind you of the last filename used during disk operations. You can cancel the Read and Write functions by simply pressing RETURN at the filename prompts.

F. Displays the function key menu. (This is discussed in detail below.)

P. Displays the print menu (also discussed in detail below).

S. Sorts the file. The file can be sorted using one or two fields. (There must be at least two records in the file before it can be sorted.) The screen will show the first record in the file. Use this screen to indicate how the file should be sorted. The first field will be highlighted in white (this is an indication of which field is currently active). Use the CRSR-down key to activate the field you want to sort.

A message on the bottom screen line will tell you to select a primary sort field. You can select this field by pressing the up-arrow key when that field is highlighted.

If you're going to sort by two fields, the first field is the primary sort field. All the records with a common entry in the primary field will be grouped together, and these will then be sorted according to the second sort field.

After selecting a primary field, a prompt on the lower screen line will ask you to select a second field. Press RETURN if you don't want to sort by two fields, and the sorting process will begin. If you want a second sort field, use the CRSR-down key to activate another field and then press the up-arrow key. Sorting will begin without pressing RETURN.

Note that sorting is done in ascending order by the character's screen code. So, records will be arranged alphabetically after sorting. All data is treated as text even though some of the fields may contain numbers. *Sorting by a field that contains numeric data in some records and text data in others will cause the text-containing records to be moved below the numeric records in the file.* This happens because the screen codes for alpha-characters are smaller than the numeric characters.

A problem may seem to exist when sorting by a field that contains numeric data only, but remember—all data is handled as text. For example, the number 1001 will sort as being smaller than the number 871, because when sorting, the records are compared one character at a time, and 1 is smaller than 8. If you allow leading spaces for numbers with fewer digits, they'll sort correctly.

Q. Exits Speed File. You'll be prompted to verify you really want to quit. Be sure to save your work before quitting.

$. Displays the disk directory. The space bar may be used to pause the listing on the screen or exit to the main menu when you've finished viewing the directory.

Function Key Menu

f1. Pressing this key once enters the record view mode. You can use this key from either the main menu or the function key menu. The first record in the file will be displayed. Further presses of f1 will display additional records in the order that they are contained in the file. Whenever the message VIEW RECORDS IN FILE is displayed at the top of the screen, the f1 key may be used to page through the file. When the end of the file is reached, the process will continue, wrapping around to the first record. When viewing records, a sequential record number will appear at the upper-left corner of the screen in the message area.

f2. This key is used to page backward through the file. You must first be in the view mode and beyond the first record for this key to be active. When the first record in the file is reached, paging will stop.

f3. To add a record to the file, press f3 either at the main menu or the function menu. The screen format you designed will be displayed, and the first field will be highlighted. Start entering your data. If you type past the end of a field, the cursor will jump to the next field, and it will be highlighted.

The CRSR-down key will acti-

vate the next field, and the cursor will be placed at the first location of that field. If you're on the last field, the cursor will move to the first. The CRSR-up key moves the cursor to the first location of the previous field on the screen and activates it.

The CRSR-left and CRSR-right keys work normally within a field, but if you move beyond the limits of a field, the cursor will jump to the next field. The RETURN key works just like CRSR-down. Nothing (including spaces) is entered by pressing RETURN. In fact, nothing is entered until the up-arrow key is pressed. So, you can go from field to field entering or editing data. When you're satisfied, enter the record as a unit by pressing the up-arrow key.

The record number is displayed in the upper-left corner of this screen in the message area. After a record is entered, the record number is incremented and the fields are cleared. You can now enter another record or exit to the main menu by pressing f7.

Note that when entering data in a field, the INSerT key doesn't function, and the DELete key works, but in a slightly different way. When the DELete key is pressed, the cursor moves left one space and blanks out that character. The character under the original cursor position and those to the right are not affected. The DELete key will erase characters, moving left, to the first position in a field. When the cursor is on the first character of a field, the DELete key will not function.

Including punctuation marks in your records won't cause any problems. You may elect, for example, to combine a city and state in a field and separate them with a comma. Quotation marks are also allowed, as are semicolons and colons. These characters don't have the special meaning they do in BASIC.

Also, with Speed File you can enter an empty field. In fact, an entire empty record may be entered into the file, if you choose. You may want to reserve an empty record for data that you don't have at the moment and go back and fill it in later.

All the fields can be cleared by pressing f3. You'll start over with the same record number.

f4. When in the view mode, a record may be deleted by pressing f4. The record deleted is the record currently being viewed. This is the only way a record can be deleted from the file. You can get to this record by paging through the file with f1 or by finding it as described below. You must verify a deletion before a record is purged from the file. After deleting a record, the other records in the file are moved into the vacancy created, and as a result, you'll be viewing what was the next record in the file. If the last record in the file is deleted, the main menu will appear since there's no next record to display.

f5. If you know the number of a record, you can jump directly to it by pressing f5 and entering its number at the prompt. The requested record will be displayed in viewing mode. You may page backward or forward or use any of the other options available from viewing mode from this point.

The main menu will return if the requested number is not in the file. You can cancel this function by pressing RETURN without entering a number.

f6. Use this function to search the records for a specific string. The search is a global search—all fields of all records are searched for a match to the string you specify. If you need to find a record but only know a small portion of what that record might contain, the search function will track it down. If no match is found, the main menu will appear. If a match is found, you can either continue the search for other possible records that might match or end the search and enter view mode. Press E to exit the search after a record has been found or press C to search further.

The view mode will be in effect if you exit the search. The record that was found may be modified or deleted, or you can page forward or backward through the file from this point.

The search function can be canceled by pressing RETURN at the prompt without entering a search string.

f7. You can return to the main menu when in the view mode or add records by pressing f7. If you are adding or modifying records when f7 is pressed, no entry in the file will be made.

f8. While viewing a record, you can modify the data by pressing f8. The top lines change to indicate that you can change the record, and the first field will be highlighted. The process is the same as adding a record. Move the cursor to where you want to make changes, and type over your old data. Press the up-arrow key to enter the changes. The record view mode will be in effect after making modifications.

Printer Menu

Three steps are required to set up a printout format. Once the process is started, you must continue through all three steps. It's best to be prepared to enter the required information by designing your report format in advance.

Press E from the printer menu to enter headings for the report. The first screen that appears is identical to the one used to enter records. Now is your only chance to exit this procedure. If you're not ready to enter the data, press f7 and then the printer menu will appear.

A message at the top of the screen tells you to enter column headings. Enter each heading in the information field following the field's title. At first, random characters may appear in this area. Type over them to enter your headings. When you've entered the heading for a column, press the space bar to type over and eliminate any random characters remaining in the field.

Column headings will normally be titles or short descriptions of each field. Since you're typing in the same field format as when adding records, the length of the column heading is limited to the length of the field.

When you've finished typing your choices for column headings, press the up-arrow key. The headings will be entered and the fields cleared. The message at the top of the screen will prompt you to enter the column numbers.

Think of the column numbers as tab positions where you want each field to print on the paper. The first time this process is done, all the field areas will show 0's. This is the setting that will prevent a field from printing. If you want a field to print on the first column of the

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page, set the column number to 1.

Four special keys are used to change the column numbers. To increase the tab setting, press and hold the + key. The column number will increment. To decrease a tab setting, press and hold the − key. The column number will decrement. When 0 is reached, the number will wrap around to 255—the largest possible tab setting.

To clear a tab, press 0. The column number will change to 0. This is the method used to select which fields will print. A 0 here means to exclude this field from the report. At least one field must be set to print. Don't leave all of the fields set to 0, or you will have a problem when trying to enter the report heading.

Use the RETURN key to move from one field to the next. Press +, −, or 0 to adjust the tab setting for each field, taking care not to overlap any fields. If the first field to be printed starts in column 1 and is ten characters long, the second field on the printout cannot start in any column before column 11. Speed File will check for overlapping fields, but you should plan where you want each field to print to obtain a neat report.

Fields may be printed in any order and in any column, limited only by the setting of the printer. If your printer is capable of a maximum of 96 columns, it's up to you to design and set the tabs to keep within this limit. If it's necessary to change your printer settings to change the maximum number of columns or the print pitch, send the commands to the printer as described below.

Again, use the up-arrow key to enter the column number information after adjusting each field. The screen for entering the report header should appear next. If the column/number screen reappears, double check your tab settings—there is an overlap of fields somewhere. If no errors are detected, the report header can be entered.

A blinking cursor will prompt you to enter a report heading. The length of the heading cannot exceed the width of the report printout. If you're only going to use 16 columns in the report, for example, the report heading is limited to 16 characters. Press RETURN to enter the heading. If you've exceeded the limit for the length of the heading, the cursor will go back to the beginning of the input.

Now you can see the problem created by setting all of the tabs to 0. You can't possibly have a report heading short enough to meet the length requirement. Press the RUN/STOP–RESTORE combination if you find yourself stuck in this position and the main menu will appear.

After entering the report header, the printer menu will be shown. If you press E, all the information you entered will be displayed, and you'll have an opportunity to make changes. If you don't want to edit your choices, press the up-arrow key at the first two screens, followed by RETURN at the report heading screen, and all the data will remain intact.

Press P to print the report. If the information for column headings, tabs, and report heading previously have not been entered, the report won't print. Instead, the screen for entering this data will be shown. If the printer is online and all the preparatory steps have been performed, the report will be sent to the printer.

You can interrupt printing by pressing and holding down the RUN/STOP key until printing ceases.

Printing Labels

Speed File is also capable of printing labels. The format used is specifically designed to print the file on mail labels spaced on one-inch centers. This type of mail label will accommodate a maximum of 6 lines with 35 characters per line (with the print pitch set to 10 cpi). The records will be printed one field to a line, so if you plan to use Speed File to print mail labels, the file should be set up accordingly.

Before labels can be printed, the information requested in the

Database Terms

Databases are powerful tools for many applications. They can manage any information you need to store and retrieve. "Speed File" allows you to easily create and manage any number of files by providing easy-to-use menus and commands for creating, adding, sorting, editing, searching, and printing information.

Because Speed File is a general-purpose file manager, it can be used for many applications. It's not designed to fulfill a specific purpose, so it's general enough to handle many different types of files. For example, you could create a name and address file (name, street, city, state, zip code, and phone number), a file for your garden (plant name, gestation, watering/feeding needs, and harvest time), and a file for your library (title, author, publication date, publisher, and subject).

Each grouping of information within a file is a *record*. For example, "John Doe, 123 Main Street, Anywhere, USA 11111, 888-999-9999" could be one record within an address file. When you enter a new name, address, and so on, you're adding another record. In Speed File, there's no restriction to the number of records (outside of the normal limitations of computer memory and disk space), but exercise common sense when creating a file. Remember, the longer your file, the longer the search time to find a record. And if the record size is fairly small, you'll be able to fit more records into available memory.

Finally, each record contains one or more *fields*. In the examples above, name, street, and city are individual fields within the address file, and author and publisher are fields in the library file.

Think of the structure as a recipe card box. The entire collection of cards is the file. Each card is a record inside the file. And each line on the card is a field.

If you see how all this information is organized, you can see how useful a file manager like Speed File can be. There are a multitude of applications. Aside from those noted above, you can create a file for home inventory, collections (cards, coins, stamps, record albums, and so on), gifts, recipes, Christmas cards, and mailing labels, to name just a few.

ENTER/EDIT HEADING INFO section must be given. Enter this data as if you were designing a report format. When labels are printed, all of the heading information is ignored. However, the tab settings are important. The column numbers for each field determine in what *order* the fields will be printed, one field per label line. Remember, even if you are not planning to print a report, the settings must be entered so fields don't overlap. Set the column number to 0 for any field you want to exclude from the label. This set-up may seem strange at first, but with it, you can often use the same printer format for both reports and labels.

After making preparations, press L, and the file will be printed in label fashion. As with report printing, the label printer can be stopped by pressing and holding the RUN/STOP key.

Once you've designed a report format with the ENTER/EDIT HEADING INFO feature, the data is saved with the file. Unless you want to make changes, the preparatory steps need to be taken only once. After that, the file can be printed by pressing L for labels or P for report printouts.

To send special codes to the printer—to alter the print pitch, for example—press S at the *printer menu.* Enter the codes, in decimal numbers, at the command prompt. Press RETURN after each code is entered and a new prompt for succeeding codes will appear. Up to 12 codes may be sent at one time. Press RETURN without making an entry at the prompt to send the codes to the printer and exit to the printer menu. (See your printer manual for the proper codes to change printer settings.)

To return to the main menu, press X.

See program listing on page 90.

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Phantom LIST

Buck Childress

This short machine language routine lists BASIC programs from disk to the screen without disturbing what's currently in memory. For the 128.

Listing a disk's directory is informative, but it doesn't tell you everything about the files that are saved on disk. To truly tell which version of what program is hidden behind each filename, you must load and list every program in question. Unfortunately, this process is not only slow, but it erases whatever BASIC program is currently in memory.

"Phantom LIST" lists BASIC programs that are stored on disk without actually loading them into memory. This way, you can view a program's listing while keeping intact the BASIC program that you're working on. Phantom LIST works on the 128 in 128 mode only. If you own a 64, you can list BASIC programs from disk using the DLIST command available with "Meta-BASIC" (most recently published in the February 1987 issue of COMPUTE!'s Gazette).

Getting Started

Type in Phantom LIST and save a copy to disk. Phantom LIST is a machine language program written in the form of a BASIC loader. When run, the BASIC loader POKEs the machine language into memory while checking for errors in DATA statements. If no errors are detected, the message SYS 4864 TO ACTIVATE appears. Type SYS 4864 and press RETURN to activate the program.

Using The Program

To view BASIC programs using Phantom LIST, press the back-arrow key (←) and RETURN. At this point, Phantom LIST asks you for a filename. Enter the filename of the BASIC program that you wish to list. You may use the DEL key to edit what you enter. Press RETURN when you are done. You must enter at least one character.

If the disk contains the program file specified, the BASIC program will list to the screen. To slow down the listing, press the Commodore key. The SHIFT key temporarily freezes the listing, and the RUN/STOP key aborts the listing completely, returning you to the BASIC editor.

Phantom LIST contains some extra features. To read the disk's error channel, for example, simply enter the @ character and press RETURN. The current drive status is echoed to the screen. If Phantom LIST is unable to list the program specified, it may be the result of a disk error. To check, you can use the @ function to see what the problem is.

Before Phantom LIST tries to access disk files, it checks to see whether the disk drive is connected. If it isn't, the message DEVICE NOT PRESENT appears. Usually this means that your disk drive is turned off. In this case, a flick of the power switch is all you need to remedy the situation.

You may deactivate Phantom LIST by typing Q followed by RETURN. To reactivate the program, enter SYS 4864.

See program listing on page 95.

DGraph
Hi-Res Commands For BASIC

Dan Coy

Spice up your BASIC programs with hi-res graphics. "DGraph" is a full-feature extension to BASIC that supplies you with all the commands you need to create attractive hi-res screens from within your BASIC programs. Text and graphics can be freely intermixed on the screen. For the Commodore 64 with a disk drive. A drawing program is included (joystick required).

Have you ever written a great program, only to get stuck when you're ready to add the graphics? Perhaps you couldn't get the bar chart just right. Or maybe your line-drawing routine was just too slow to use in the finished program.

"DGraph" is an extension to BASIC that makes hi-res graphics simple and fast. It adds more than a dozen commands, allowing you to pattern-fill areas, draw solid or dotted lines, plot points, save your screens to disk, and more. These commands are performed at machine language speed, providing you with the power you always expected from your computer.

To help you get acquainted with DGraph, three demo programs are included. A joystick-driven drawing program is also included. Using these demos as examples of what you can do, you'll soon be writing your own programs that take advantage of the power of DGraph.

Getting Started

DGraph (Program 1) is written entirely in machine language. Type it in with the "MLX" machine language entry program located elsewhere in this issue. When MLX asks for a starting and ending address, respond with the following values:

Starting address: C000
Ending address: CFAF

After you've finished typing in the data for DGraph, be sure to save a copy to disk before leaving MLX. Program 2 expects to find DGraph in a file named "DGRAPH.OBJ", so use that name when saving the program.

Now, type in Program 2, "DGraph Loader." This program is written in BASIC. After you've typed it in, save a copy to the same disk as Program 1 with the name "DGLOADER".

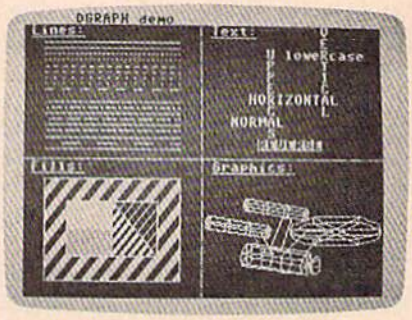
Programs 3–6 are demonstration programs written with DGraph. Before typing them in, follow the instructions below for installing DGraph. Whenever you wish to enter or run a program that uses DGraph commands, you must first install DGraph.

Installing The Program

Since DGraph is a RAM-based extension of BASIC, you must load it before entering BASIC programs that contain DGraph commands. To install DGraph, type LOAD"DGLOADER",8. Then type RUN. When the machine language DGraph program has been loaded from disk, you'll see the message *DGraph Installed.*

You may now enter DGraph programs. For your first try, you might want to type in Program 3, a short graphics demo. When you've finished typing it in, be sure to save the program to disk.

Program 4 is another short graphics demo. Program 5 takes DGraph through its paces. The screen photo shows the output of Program 5.



Patterned line and fill commands, as well as versatile text commands, make hi-res graphics easy.

Program 6 is a simple drawing program that uses both the joystick and keyboard as input devices. Plug a joystick into port 2 to use the program. You'll see a small pixel cursor. Move it with the joystick. You can draw by pressing the fire button as you move.

Besides drawing with the joystick, you can also add text to the hi-res screen. Just move the pixel cursor to where you want the text and begin typing. You can also move the cursor in eight-pixel increments by using the cursor keys. Pressing the HOME key will move the cursor to the upper-left corner of the screen, and pressing the CLR key will clear the screen. Additional drawing features can be accessed by pressing the CTRL key. The following commands are available:

G	Get a file
S	Save a file
P	Print screen
D	Draw a line
F	Fill a regular polygon
U	Uppercase
L	Lowercase
N	Normal characters
R	Reverse characters
C	Clear screen
Q	Quit

Each of the commands will prompt you for any additional information necessary to complete the command. For example, the *Get a file* and *Save a file* commands prompt the user for a filename. The print screen option is designed to work with Commodore 1525 and compatible printers. (These include all odd-numbered Commodore printers (MPS-801/803), the Commodore MPS-1200, and suitably interfaced non-Commodore printers). The *Draw a line* command requires the starting point of a line be set the first time the command is used. For each additional use, the end of the previous line will be the beginning of the new line. The *Fill a regular polygon* command will ask whether the cursor is inside the polygon to be filled. This is just a safeguard to prevent accidental ruin of a picture. If you answer positively, the fill will be executed, otherwise you will be returned to the option menu. The *Uppercase, Lowercase, Normal characters, Reverse characters,* and *Clear screen* commands are executed without additional input from the user. The Quit command asks whether you want to go back to joystick mode or to BASIC. Reply by typing either *j* or *b*.

Since the drawing program is written in BASIC, you should find it easy to modify.

The New Commands

After trying a few of the demos, you'll probably want to write your own DGraph programs. Below is a list of the new commands that are available:

@1	Go to text screen.
@2	Go to hi-res screen.
@3	Clear hi-res screen.
@4,x%,y%	Move pointer to given point.
@5,x%,y%	Place a dot at given point.
@6,x%,y%	Erase a dot at given point.
@7,x%,y%,s%	Draw a line to given point.
@8,x%,y%,s%	Erase a line to given point.
@9,x%,y%,s%	Flood-fill an area with a pattern.
@10,x%,y%,c$	Print a string horizontally.
@11,x%,y%,c$	Print a string vertically.
@12,"filename"	Save the hi-res screen to disk.
@13,"filename"	Load a screen from disk.
@14	Dump graphics screen to printer.

In the command list above, the percent sign (%) indicates an integer variable. A dollar sign ($) indicates a string variable. The x% parameter can range from 0 to 319 with 0 being on the left side of the screen and 319 on the right. The y% parameter can range from 0 to 199 with 0 being at the bottom of the screen and 199 at the top.

Note that three commands, *@7*, *@8*, and *@9*, have a "style" parameter. For lines, different style numbers create different dot patterns. For the *fill* command, different style commands create different fill patterns. In general, style numbers range from 0 to 127, with 0 being a solid line or fill. Command @7 also allows style numbers between 128 and 255. When drawing a line in one of these styles, the line drawing halts as soon as an "on" pixel is encountered. Note that lines must be erased in the same direction in which they were drawn.

The print string commands, *@10* and *@11*, have a string parameter which may be up to 48 characters long. The print string functions do not wrap around, so strings which are too long to fit onto the screen will be truncated. This means that the longest horizontal string that can printed to the screen is 40 characters. The longest possible vertical string is 24 characters.

The dump graphics screen command works with the Commodore 1525 and compatible printers. (All odd-numbered Commodore printers are compatible with the 1525. The MPS-1200 is also 1525-compatible.) The graphics dump comand will not work with the Commodore 1526 or other even-numbered Commodore printers. To use non-Commodore printers which do not have a Commodore emulation mode, you must have an interface which will emulate the Commodore 1525 graphics mode.

Here's a short DGraph program that illustrates several of the commands:

```
10 @2:@3
20 @4,0,0
30 @7,100,100,0
40 @10,10,10,"TEXT STRING"
50 END
```

Line 10 switches on the hi-res screen and clears it. Line 20 moves the cursor to the lower-left corner of the screen (0,0). Line 30 draws a line from the last cursor position (0,0) to (100,100). The style is set to 0 (a solid line). Line 40 prints the string "TEXT STRING" on the hi-res screen at text position 10,10.

When you use the *fill* command, be sure to select a point inside the area that you wish to fill. DGraph's *fill* command (*@9*) is not a flood fill. It works best with regular polygons and other convex areas. If the area you try to fill does not fill completely, choose another point within the area and fill again. Once an area is filled, it cannot be filled again with another pattern. If you're not sure which fill pattern to use, save your screen to disk before trying one.

Making Mistakes

DGraph has its own error messages. Here is a list of DGraph's error codes:

1 Character string too long (must be 48 characters or less)
2 Unrecognized input
3 Not a valid variable name
4 Variable name not defined
5 I/O error (disk or printer)
6 DGraph internal math error
7 Invalid command number
8 Invalid style number
9 Coordinates out of range
10 Text out of range

Advanced Tricks

To check the value of a pixel (whether it's on or off), move to that pixel with the @4 command and then PEEK location 251. If the pixel is off, the value will be 0. Otherwise, it will be some other nonzero number.

Text modes can be changed by printing the appropriate control character. Here's one way to do it:

```
C$=CHR$(CC%):@10,0,0,C$
```

The value of CC% determines the mode. Use 14 to switch to lowercase text, 142 for uppercase text, 18 for reversed text, and 146 for normal text.

See program listings on page 80.

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Smart VAL

Randy Thompson

Give your 64's VAL function a lesson in mathematics with this short-but-powerful machine language routine. Surpassing simple string-to-number conversions, "Smart VAL" gives BASIC's VAL statement the ability to evaluate complex mathematical expressions. Now, formulas containing numbers, variables, operators, and mathematical functions can be placed into strings and calculated at machine language speed.

When does 2 + 2 = 2? Whenever you use the 64's VAL function. Enter PRINT VAL("2 + 2") and prove it for yourself. You see, VAL is not very smart—it stops evaluating a string the moment it encounters a nonnumeric character (in this case, the space). Because of its limitations, VAL is one of BASIC's least used functions.

"Smart VAL" wedges into BASIC, enhancing the VAL function so that it evaluates strings in exactly the same manner that BASIC evaluates mathematical expressions. In other words, X = INT((Y+2)/3) produces the same result as X = VAL("INT((Y+2)/3)"). Smart VAL can evaluate any number, variable, operator, or mathematical function available in BASIC.

With Smart VAL, BASIC becomes a powerful, number-crunching language. Normally, mathematical equations have to be hard coded into a program. A BASIC accounting program, for example, must actually be modified to accommodate a new depreciation formula. With Smart VAL, however, formulas can be entered by the user, input from disk, or dynamically generated by the program itself.

Typing It In

Smart VAL is a machine language routine written in the form of a BASIC loader. Be sure to use the "Automatic Proofreader," found elsewhere in this issue, when typing in the program. After you have entered Smart VAL, save a copy to tape or disk.

Using Smart VAL

To activate Smart VAL, load and run the program. Once the machine language data has been POKEd into memory, the BASIC loader is no longer necessary. If you wish, you may include lines 1000–1340 of Smart VAL's BASIC loader in your own programs. Just remember to execute a GOSUB 1000 prior to using the improved VAL function.

With Smart VAL, you use the VAL function as you would normally. Only now, VAL is much more intelligent: It can evaluate expressions using any numeric function available to BASIC—INT, SIN, AND, OR, *, /, parenthesis, exponential numbers, and so on.

The formulas placed within strings are calculated using the same order of precedence and the same level of accuracy that BASIC provides for all of its floating-point equations. You can even place a BASIC variable within the equation. For example, the code FOR I=0 TO 7:PRINT VAL("2↑I");: NEXT produces the following output: 1 2 4 8 16 32 64 128.

When using Smart VAL, you should never nest VAL statements. For example, the command PRINT VAL("VAL(A$)") does not work—if anything, it will crash the computer. Other than this, Smart VAL is fairly bulletproof, surviving even the RUN/STOP–RESTORE key combination.

Here's a short three-line program entitled "Mini-Calc" that makes use of Smart VAL.

```
10 PRINT:EX$="":INPUT "INPUT A
   NUMERIC EXPRESSION";EX$
20 PRINT EX$;" =";VAL(EX$)
30 GOTO 10
```

To use this program, simply enter a numeric expression and press RETURN. Instantly, your expression is evaluated and the result is echoed to the screen. Although simple in operation, writing a program such as Mini-Calc in standard 64 BASIC is next to impossible.

Error Trapping

As with all BASIC commands, numeric expressions must follow certain rules of syntax. When Smart VAL encounters an error, two things happen: First, the VAL function returns a value of 0; second, memory location 781 contains an error code. Here's a description of all the possible error codes:

PEEK(781)	Error Description
0	No errors
11	Syntax error
14	Illegal quantity error
15	Overflow error
22	Type mismatch error
23	String too long error
25	Formula too complex error
27	Undefined function error

If you wish, you may ignore errors, taking for granted that expressions containing errors return a value of 0.

Most of the errors listed above are self-explanatory. Error number 23, however, is a special case. Al-

though BASIC allows strings to be 255 characters in length, Smart VAL can evaluate strings of only 80 characters or less. Because of this, Smart VAL returns a *string too long* error whenever strings containing more than 80 characters are evaluated.

Normally, Smart VAL does not halt program execution when an error occurs. By making the following change to Mini-Calc's line 20, however, you can change this:

```
20 PRINT EX$;" =";VAL(EX$):IF
   PEEK(781)< >0 THEN SYS 42039
```

Now, evaluation errors cause the program to halt, displaying the appropriate error message. If you wish to print the error message without stopping the program, add the following lines to Mini-Calc:

```
22 E=PEEK(781)*2:IF E=0 THEN 10
24 EA=PEEK(41766+E)+PEEK
   (41767+E)*256:PRINT "?";
26 C=PEEK(EA):PRINT CHR$(C AND
   127);:IF C<128 THEN EA=EA
   +1:GOTO 26
28 PRINT " ERROR"
```

Compatibility

Smart VAL is compatible with all BASIC programs, and most machine language routines. Currently, Smart VAL is stored in memory at 49152–49358 ($C000–$C0CE). If needed, Smart VAL may be relocated by changing the variable SA in line 1010 to equal a different starting address.

Although Smart VAL is completely relocatable, it may not work with programs that make use of BASIC's CHRGET routine or use memory locations 1015–1023 ($03A7–$03FF).

How It Works

To evaluate numeric expressions, Smart VAL uses several of BASIC built-in ROM routines—the most important of which is called formula evaluate (FRMEVL). Located at 44446 ($AD9E), this routine contains a very powerful group of subroutines which evaluate and calculate numeric and string expressions. Before an expression can be evaluated, however, it must be tokenized. Fortunately, there is a ROM routine to do this as well.

When called, Smart VAL places the string parameter into BASIC's input buffer located at 512 ($0200). So that the original contents of the input buffer are not lost, any data located in the input buffer is temporarily transferred to the upper part of the 64's cassette buffer. Now, BASIC's CRUNCH routine—located at 42361 ($A579)—is called to tokenize the input buffer's new contents.

After tokenizing our formula-string, Smart VAL calls upon FRMEVL to do its magic. Once FRMEVL evaluates the expression, Smart VAL returns the calculated result, restores the input buffer's contents, and returns control to BASIC's interpreter.

During a formula's evaluation, Smart VAL changes BASIC's error vector—located at 768–769 ($0300–$0301)—to prevent errors from halting a program's execution. When an error occurs, Smart VAL stores the error number in location 781 ($030D) and returns a function value of 0. Before returning to BASIC's interpreter, the error vector is restored. By bypassing BASIC's normal error handler, Smart VAL becomes a much more useful utility.

See program listing on page 86.

COMPUTE!'s Gazette is looking for utilities, games, applications, educational programs, and tutorial articles. If you've created a program that you think other readers might enjoy or find useful, send it to: **Submissions Reviewer, COMPUTE! Publications, P.O. Box 5406, Greensboro, NC 27403.** Please enclose an SASE if you wish to have the materials returned.

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Ramdisk 128

Peter M.L. Lottrup

This powerful utility creates a ramdisk in your 128's memory and allows you to load and save BASIC and ML programs literally at the speed of light. No hardware modifications are necessary for you to move your computer's input and output into the fast lane.

The Commodore 128 has a luxurious amount of memory. In fact, most of the time, large areas of this memory remain idle. Bank 1, where BASIC variables are stored, reserves nearly 63K of memory for variables, and most of the time—even when using lots of string variables and arrays—little of this memory is actually occupied. "Ramdisk 128" takes 40K of this Bank 1 memory and creates a ramdisk that allows you to load and save files of all kinds at lightning-fast speeds.

Installation

Ramdisk 128 consists of two programs. "Loader" (Program 1) is a BASIC program that performs some housekeeping duties and loads "128-RAMDISK" (Program 2). Since Loader (Program 1) is written in BASIC, simply type it in and save a copy to disk.

128-RAMDISK (Program 2) is written in machine language, so you'll need to enter it with the 128 version of the "MLX" machine language entry program found elsewhere in this issue. When you run MLX, you'll be asked for the starting and ending addresses of the data you'll be entering. Here are the values to use for 128-RAMDISK:

Starting address: 1300
Ending address: 1BE4

Follow the MLX instructions carefully, and save a copy of the MLX data before you leave MLX. Be sure to use the name 128-RAMDISK because the Loader program (Program 1) will look for a file with this name.

Now, to install Ramdisk 128, simply load LOADER like any other BASIC program and type RUN. When the READY prompt returns, type NEW, and you're ready to begin using the ramdisk commands.

Ramdisk Commands

Once the ramdisk is installed, you'll have several new commands added to BASIC. Let's look at each one.

ESAVE is used to save programs to the ramdisk. To save a BASIC program, just follow ESAVE with the filename enclosed in quotation marks (the closing quotation mark may be omitted for BASIC programs). For machine language files (ML routines, text screens, hires screens, and so on), specify the filename, the starting address, the ending address, plus one of the saves, separated by commas. Don't use the letter *P* before the numeric ranges of the save.

If no filename follows the ESAVE command, a full save is specified. In a full save, all programs in the ramdisk are saved to your disk drive under the filename RAMFILES. This option saves all programs currently recorded in the ramdisk. If the ramdisk memory is full when it is saved, you must have 162 blocks free on the disk, or a RAMDISK FULL error will occur.

ELOAD is used to load programs and files from the ramdisk to memory. The asterisk (*) can be used for wildcard searches. An asterisk by itself loads the first file from the ramdisk. If no parameters follow the filename, two things may happen: If the program was saved as a BASIC program, it will be reloaded into the current BASIC programming space; if it was a machine language file, it will be reloaded to the same starting address from which it was saved.

One numeric parameter may follow the filename to specify the starting address for the load.

ELOAD without any parameters will load the complete ramdisk from the disk drive. It will try to load a file called RAMFILES (which must have been previously stored with the full ESAVE command).

EHEADER may be used when you need to delete all the contents of the ramdisk. Since everything in the ramdisk will be lost, you'll be asked to confirm your action (if in command mode). This command reinitializes the directory and storage pointers, thus deleting all previous contents of the ramdisk. If used in program mode, EHEADER will not ask for confirmation.

EDIR displays a directory of all the files currently stored in the ramdisk. The screen is cleared, the heading is displayed, and the

screen is switched to blue. The filenames are then displayed, along with the starting address of each file and its length in bytes. Up to 18 files are displayed per screen. Pressing a key before the screen is full will abort the directory. Pressing a key after the screen is full displays the next screen, or pressing the STOP key aborts the directory.

Once the last screen of the directory has been displayed—or when the directory is aborted—the program restores the colors which were in use before the directory was called, clears the screen, and resumes program execution (if EDIR was used in program mode). The top line of the directory displays the number of free bytes remaining in the ramdisk.

Error Messages

When attempting to save a file larger than the remaining free bytes in the ramdisk, a RAMDISK FULL error message will be displayed, and the save will be aborted.

A DIRECTORY FULL error message is displayed if you attempt to save more than 83 files to the ramdisk.

ILLEGAL QUANTITY and MISSING FILENAME errors are reported when illegal parameter ranges are specified for an ESAVE or ELOAD operation, or when no filename is specified after the first filename quotation mark.

No error is reported if you execute a BASIC save without any program in memory, but nothing is saved to the ramdisk.

Filenames can be strings or string operations, following the same rules as the standard disk and tape commands. For example, ESAVE "PROGRAM"+STR$(I) and ESAVE (A$+B$) are both valid expressions. Numeric parameter ranges for ESAVEs or ELOADs may also be numeric expressions which will first be evaluated by the computer.

Scratching And Renaming Files

You might be wondering what to do when you want to scratch or rename a file in the ramdisk. Since the very nature of the ramdisk makes scratching and renaming commands unnecessary, these options have not been included. If you use the ramdisk while developing a program (to save each modified version), when the ramdisk is nearly full, load and save the programs you wish to keep to disk drive or tape, clear the ramdisk and continue.

When using the ramdisk to store a variety of programs—ML utilities, hi-res screens, text screens, and so on—you should first save all the files to the ramdisk and then save the contents of the ramdisk to disk with a complete ESAVE. Whenever you want to install the ramdisk, simply use ELOAD without specifying a filename or parameters, and all the programs will be installed.

In most cases, *scratch*, *rename*, and other commands are not needed. They wouldn't have been impossible to add, but the ramdisk utility itself would have been too long to fit in the free RAM at $1300, and access times would have slowed down.

The loader routine for the ramdisk utility (Program 1) allows relocation of the routine to any memory area you prefer. The routine is designed to reside at $1300 without interfering with BASIC, but may be located elsewhere. The next section describes how to relocate the ramdisk.

Program Notes

The BASIC loader loads the ML code to the address specified in line 50 and executes the necessary relocating adjustments to the program (when the routine is not located at $1300). To load the utility elsewhere in memory, change the starting address in line 50. For example, if you don't use any hi-res graphics, you can issue a GRAPHIC1:GRAPHIC0 statement and load the utility at $1C00 with SA=DEC("1C00"). Remember to SYS to the corresponding starting address whenever you want to reinstall the routine after a reset.

The ramdisk directory occupies memory addresses $6000–$6800 in Bank 1. The program files are stored in $6800–$FEFF. Memory addresses $FA–$FE and 2758–2781 are used by the ramdisk for program pointers and multiple data storage.

Whenever you reset your 128 or reload the ramdisk, the files in the ramdisk should remain uncorrupted. To reenter the ramdisk utility without losing the directory and files, enter SYS SA+52, where SA is the standard entry point for the utility. If the directory is displayed successfully, you should save the files to disk, EHEADER the ramdisk, and reload the files.

To make the ramdisk load automatically, change line 100 to read 100 ELOAD:END. *It's important to add this line to Program 1 when the ramdisk utility is activated for the ELOAD token to be created correctly.* The routine will not work otherwise (it will report a SYNTAX ERROR in line 100).

Next, create a complete ESAVE file by saving all the files you wish to be included to the ramdisk and then saving the entire contents to disk with a full ESAVE. Then, when you run Loader, it will install the ramdisk for you and will load all the contents to memory. You can further automate this procedure by making Loader an autoboot file. Then, you simply can turn on your computer with the appropriate disk in the drive, and Ramdisk 128 will be installed and loaded with your favorite files.

See program listings on page 89.

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Four For The 64

Randy Thompson

Push BASIC to the limits with these four power-packed programming tricks. By sneaking through BASIC's "back door," these short routines add functions normally available through machine language only. Without the use of lengthy BASIC loaders or cumbersome disk-based machine language files, add the ability to GOTO a program-calculated line number, selectively RESTORE to any DATA statement, BSAVE memory to disk, and list a disk's directory without disturbing the BASIC workspace. And believe it or not, all of these routines—including the directory lister—fit within two lines of BASIC code.

The 64's built-in BASIC may be limited, but it's not crippled. With a little ingenuity, you can make BASIC 2.0 go beyond its specifications. Below are four routines written in BASIC that do just that. Discover the 64's hidden talents with a calculated GOTO, selective RESTORE, BSAVE routine, and an amazingly short directory lister.

When entering each example, don't be confused by the strange syntax—just remember: It may not look like it works, but it does.

Calculated GOTO

The first "trick" provides a calculated GOTO command. To use, simply set the variable GL to equal the line number that you wish to go to, and execute the following code:

```
1000 POKE785,188:POKE786,168:S
   YS47083(GL),USR(0)
```

This short routine takes up only one BASIC line. I discovered this technique about three years ago while developing the following trick, Selective RESTORE.

Selective RESTORE

Most versions of BASIC—including those found on the 128 and Plus/4—have a RESTORE command that accepts a line number as an argument. Unfortunately, the 64's RESTORE command does not. Not so anymore. With this two-line subroutine, you can restore BASIC's data pointer to any line in your program. Simply set the variable RL to the desired line number and GOSUB 1000. If you wish, you may insert this code everywhere you use it, eliminating the need for the RETURN in line 1010.

```
1000 POKE785,232:POKE786,7:POK
   E209,232:POKE210,7:POKE211,
   0:POKE213,39
1010 PRINT" S{RVS}&${OFF}{*}
   {RVS}HD{OFF}A{RVS}${OFF}
   {SHIFT-SPACE}T{RVS}D{OFF}B
   {SHIFT-SPACE}":SYS47083(RL)
   ,USR(0):RETURN
```

Enter line 1010 with care; the slightest mistake may cause your program to malfunction.

I've seen entire machine language routines—pushing 100 bytes or more—that accomplish the same thing this BASIC code does in just two lines.

BSAVE

BSAVE allows you to save any area of the 64's memory to disk. With BSAVE you can save machine language routines, program variables, and even graphics data, such as high-resolution screens and sprite definitions.

To use this two-line BSAVE, set F$ equal to the desired filename, D equal to the drive's device number (usually 8), SA equal to the starting address, EA equal to the ending address plus one; then, GOSUB 1000. As with the selective RESTORE, you may insert this code everywhere you use it, eliminating the need for the RETURN in line 1010.

```
1000 SYS57812F$,D:POKE173,SA/2
   56:POKE172,SA-PEEK(173)*256
   :POKE780,172
1010 POKE782,EA/256:POKE781,EA
   -PEEK(782)*256:SYS65496:RET
   URN
```

This subroutine is actually very simple in operation. After setting the file parameters using a ROM routine located at 57812 ($E1D4), the program simply initializes BSAVE's starting/ending address and calls the well-documented kernal routine, SAVE.

Directory

This one has to be seen (or should I say, run) to be believed. By executing these two lines of code, you can display a disk's directory without disturbing the BASIC program in

memory. To use, simply set the variable D equal to the drive's device number, and GOTO 1000. To list the directory of the disk in drive 8, for example, use D = 8:GOTO 1000.

Enter the following lines exactly as listed. You may change the line numbers, but never the commands themselves.

```
1000 SYS57812"$",D:POKE43,1:PO
   KE44,192:POKE768,174:POKE76
   9,167:SYS47003,1
1010 POKE782,192:SYS65493:SYS4
   2291:LIST:POKE44,8:POKE768,
   139:POKE769,227
```

Compare this to the over-40-lines directory program found in the 1541 user's guide, and see which one you'd rather type in.

The concept for this program came to me while developing the BSAVE routine listed above; you may see some similarities. I believe this to be the shortest directory routine possible on the 64.

Examples

The best way to explain a programming technique is to show it in action. That's where Programs 1–4 come in: Program 1 illustrates use of the calculated GOTO routine; Program 2 shows how you can use the selective RESTORE; Program 3 uses BSAVE to create a simple notepad program (see below); and lastly, Program 4 lists disk directories at the touch of a key. After typing each program in, save a copy to disk before running.

BSAVE Notepad

Program 3 provides a simple notepad-type program. Because this program writes to disk, it requires additional explanation.

When run, Program 3 attempts to load the data file named SCREEN. If found, SCREEN is loaded into screen memory, presenting you with any notes previously entered. If SCREEN is not found, the notepad comes up blank.

At this point, you may enter or edit a screen of text. When you're finished, simply press RETURN and the program BSAVEs the screen to disk using the filename SCREEN. Do not press RETURN until you're done editing. If you need to move down a line, enter a shifted RETURN, or use the cursor-down key.

See program listings on page 86.

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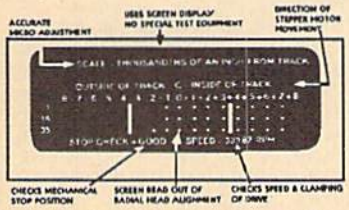

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BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," elsewhere in this issue.

DGraph

See program listing on page 72 before typing in.

Program 1: DGraph

```
C000:FF FF 00 00 FF FF AD 00 DC
C008:03 8D 02 C0 AD 01 03 8D BF
C010:03 C0 AD 08 03 8D 00 C0 88
C018:AD 09 03 8D 01 C0 AD 14 66
C020:03 8D 04 C0 AD 15 03 8D 68
C028:05 C0 78 A9 C0 8D 01 03 47
C030:8D 09 03 8D 15 03 A9 49 45
C038:8D 00 03 A9 54 8D 08 03 67
C040:A9 84 8D 14 03 58 4C 3B F7
C048:C4 8A 30 03 20 1A C4 6C 64
C050:02 C0 00 00 A5 7A 8D 52 87
C058:C0 A5 7B 8D 53 C0 20 73 3D
C060:00 C9 40 D0 06 20 FC C0 D4
C068:4C AE A7 C9 8B D0 06 20 19
C070:C0 C0 4C AE A7 AD 52 C0 50
C078:85 7A AD 53 C0 85 7B 6C C5
C080:00 C0 08 00 AD 86 02 0A C8
C088:0A 0A 0A 8D 82 C0 AD 21 3F
C090:D0 29 0F 0D 82 C0 CD 83 AD
C098:C0 F0 22 8D 83 C0 AE 11 61
C0A0:D0 10 FB A2 00 9D 00 84 33
C0A8:E8 D0 FA 9D FA 84 E8 D0 98
C0B0:FA 9D F4 85 E8 D0 FA 9D 2C
C0B8:E8 86 E8 D0 FA 6C 04 C0 CC
C0C0:20 73 00 20 9E AD 20 79 96
C0C8:00 C9 89 F0 05 A9 A7 20 3B
C0D0:FF AE A5 61 D0 08 20 09 B8
C0D8:A9 D0 03 4C FB A8 20 79 C4
C0E0:00 B0 03 4C A0 A8 08 C9 35
C0E8:40 D0 04 28 4C FC C0 C9 63
C0F0:8B D0 04 28 4C C0 C0 28 7E
C0F8:4C ED A7 00 BA 8E FB C0 D9
C100:20 7F C1 C9 01 D0 03 4C E5
C108:1A C4 C9 02 D0 03 4C EA 39
C110:C3 C9 03 D0 03 4C 3B C4 D9
C118:C9 04 D0 06 20 AA C1 4C 77
C120:02 C5 C9 05 D0 06 20 AA 29
C128:C1 4C CC C6 C9 06 D0 06 B3
C130:20 AA C1 4C D2 C6 C9 07 B7
C138:D0 06 20 B0 C1 4C A5 C6 06
C140:C9 08 D0 06 20 B0 C1 4C B8
C148:B4 C6 C9 09 D0 06 20 B0 31
C150:C1 4C E9 CA C9 0A D0 06 CF
C158:20 C7 C1 4C 7F CA C9 0B A0
C160:D0 06 20 C7 C1 4C B4 CA C1
C168:C9 0C D0 06 20 CD C1 4C 56
C170:48 CC C9 0D D0 06 20 CD 02
C178:C1 4C 7B CC 4C AB C7 20 EC
C180:F1 C1 AD 74 CF D0 0A AD ED
C188:75 CF F0 05 C9 0F B0 01 16
C190:60 A9 07 4C A2 C3 20 F1 AA
C198:C1 A2 74 A0 C0 20 B2 CC F6
C1A0:20 F1 C1 A2 74 A0 BC 4C FE
C1A8:B2 CC 20 96 C1 4C DB C6 E3
C1B0:20 AA C1 20 F1 C1 AD 74 8F
C1B8:CF D0 07 AD 75 CF 8D 3F 59
C1C0:C5 60 A9 08 4C A2 C3 20 89
C1C8:96 C1 4C CD C1 20 79 00 EF
C1D0:C9 2C F0 05 A9 02 4C A2 43
C1D8:C3 20 73 00 C9 22 D0 03 30
C1E0:4C 29 C2 20 6B C3 90 03 BD
C1E8:4C 4A C2 A9 02 4C A2 C3 62
C1F0:80 A9 00 8D F0 C1 20 79 40
C1F8:00 C9 2C F0 09 C9 40 F0 64
C200:05 A9 02 4C A2 C3 20 73 4F
C208:00 20 6B C3 90 03 4C 9B 04
C210:C2 C9 AB D0 06 EE F0 C1 7B
C218:20 73 00 20 77 C3 90 03 7B
C220:4C DC C2 A9 02 4C A2 C3 40
C228:FF A2 00 20 5D C3 C9 22 08
C230:F0 10 E0 30 90 05 A9 01 3E
C238:4C A2 C3 9D D0 CF E8 4C C2
C240:2B C2 8E 28 C2 4C 73 00 8E
C248:FF FF 20 79 00 8D 48 C2 F2
C250:A9 80 8D 49 C2 20 73 00 8E
C258:C9 24 F0 11 09 80 8D 49 A9
C260:C2 20 84 C3 C9 24 F0 05 E1
C268:A9 03 4C A2 C3 20 73 00 BC
C270:20 26 C3 A0 02 B1 FB C9 AA
C278:31 90 05 A9 01 4C A2 C3 38
C280:8D 28 C2 AA CA C8 B1 FB B2
C288:85 FD C8 B1 FB 85 FE 8A 03
C290:A8 B1 FD 9D D0 CF 88 CA 12
C298:10 F7 60 20 79 00 09 80 90
C2A0:8D 48 C2 A9 80 8D 49 C2 81
C2A8:20 73 00 C9 25 F0 11 09 CF
C2B0:80 8D 49 C2 20 84 C3 C9 93
C2B8:25 F0 05 A9 03 4C A2 C3 9A
C2C0:20 73 00 20 26 C3 A0 02 B8
C2C8:B1 FB 8D 74 CF C8 B1 FB 20
C2D0:8D 75 CF A9 00 8D 76 CF 02
C2D8:8D 77 CF 60 A2 7C 20 52 9C
C2E0:CF A2 78 20 52 CF A2 74 93
C2E8:20 52 CF A9 0A 8D 79 CF F0
C2F0:20 79 00 20 77 C3 90 19 EB
C2F8:8D 7D CF A2 74 A0 78 8A 6A
C300:20 A7 CD A2 74 A0 7C 8A 0F
C308:20 34 CD 20 73 00 4C F3 90
C310:C2 AD 74 CF 10 05 A9 06 DD
C318:4C A2 C3 AD F0 C1 D0 01 F2
C320:60 A2 74 4C DD CC A5 2D 6E
C328:85 FB A5 2E 85 FC A0 00 6A
C330:B1 FB CD 48 C2 D0 0A C8 04
C338:B1 FB 88 CD 49 C2 D0 01 7D
C340:60 18 A5 FB 69 07 85 FB E0
C348:90 02 E6 FC A5 FC C5 30 22
C350:90 DE A5 FB C5 2F 90 D8 31
C358:A9 04 4C A2 C3 A9 00 85 B3
C360:83 20 73 00 48 A9 EF 85 6E
C368:83 68 60 C9 41 90 06 C9 96
C370:5B B0 02 38 60 18 60 38 F1
C378:E9 30 90 06 C9 0A B0 02 4D
C380:38 60 18 60 20 73 00 20 34
C388:6B C3 B0 F8 20 77 C3 B0 73
C390:F3 4C 79 00 0D 44 47 52 AE
C398:41 50 48 20 45 52 52 4F 47
C3A0:52 20 85 FB 20 1A C4 20 DC
C3A8:CC FF A2 00 BD 94 C3 20 D2
C3B0:D2 FF E8 E0 0E D0 F5 A5 12
C3B8:FB C9 0A 90 0A A9 31 20 74
C3C0:D2 FF 38 A5 FB E9 0A 18 C6
C3C8:69 30 20 D2 FF A9 20 20 49
C3D0:D2 FF A9 0D 20 D2 FF AE C2
C3D8:FB C0 9A A9 F7 C9 F7 08 5B
C3E0:20 CC FF 85 C6 28 4C 2F A2
C3E8:A8 15 AD 02 DD 09 03 8D 86
C3F0:02 DD AD 00 DD 29 FC 09 3D
C3F8:01 8D 00 DD AD 18 D0 C9 7B
C400:15 F0 06 C9 17 F0 02 A9 D7
C408:15 8D E9 C3 A9 18 8D 18 D9
C410:D0 AD 11 D0 09 20 8D 11 91
C418:D0 60 AD 02 DD 09 03 8D 9E
C420:02 DD AD 00 DD 29 FC 09 6E
C428:03 8D 00 DD AD E9 C3 8D 9E
C430:18 D0 AD 11 D0 29 DF 8D 39
C438:11 D0 60 A9 A0 85 FC A2 DC
C440:BF A9 00 85 FB A0 00 91 60
C448:FB C8 D0 FB E6 FC E4 FC CD
C450:B0 F5 60 00 FF AD C1 CF C5
C458:29 F8 8D 54 C4 AD BD CF D3
C460:29 07 0D 54 C4 A8 A9 00 43
C468:85 FC AD BD CF 29 F8 0A A4
C470:26 FC 0A 26 FC 0A 26 FC 49
C478:85 FB AD BD CF 4A 4A 4A DB
C480:18 6D C0 CF 69 A0 65 FC 1C
C488:85 FC AD C1 CF 29 07 8D A4
C490:54 C4 38 A9 09 ED 54 C4 84
C498:AA CA A9 00 38 2A CA D0 30
C4A0:FC AE B3 C6 F0 02 49 FF 59
C4A8:8D 53 C4 60 A2 00 AD C0 9D
C4B0:CF 10 01 60 F0 0D C9 01 9C
C4B8:F0 01 60 AD C1 CF C9 40 03
C4C0:90 01 60 AD BC CF F0 01 C1
C4C8:60 AD BD CF C9 C8 90 01 36
C4D0:60 A2 01 60 78 A5 01 29 DE
C4D8:FE 85 01 B1 FB AE B3 C6 47
C4E0:F0 06 2D 53 C4 4C EB C4 33
C4E8:0D 53 C4 91 FB A5 01 09 01
C4F0:01 85 01 58 60 20 AC C4 A3
C4F8:8A D0 01 60 20 55 C4 4C 4E
C500:D4 C4 20 C4 C8 85 FB A2 6E
C508:B0 A0 B8 20 B2 CC A2 AC E7
C510:A0 B4 20 B2 CC A2 C0 A0 5B
C518:B0 20 B2 CC A2 BC A0 AC 1D
C520:4C B2 CC A2 B0 A0 70 20 4B
C528:B2 CC A2 AC A0 6C 4C B2 61
C530:CC A2 70 A0 B0 20 B2 CC 1B
C538:A2 6C A0 AC 4C B2 CC 00 D5
C540:00 00 FF FF 00 A2 98 20 A7
C548:52 CF EE 99 CF A2 B8 A0 83
C550:C0 20 B2 CC A2 B4 A0 BC 4D
C558:20 B2 CC A2 B0 A0 B8 A9 87
C560:A8 20 94 CD A2 AC A0 B4 75
C568:A9 A4 20 94 CD A2 A8 20 A9
C570:D0 CC D0 0A A2 A4 20 D0 0B
C578:CC D0 5A 4C F5 C4 A2 A4 5B
C580:A0 A8 A9 A0 20 4C CE A2 38
C588:A0 A0 9C 20 B2 CC A2 9C CC
C590:20 07 CD A2 9C 20 19 CD 37
C598:10 3B A2 A8 20 D0 CC 10 C7
C5A0:1F A2 98 20 DD CC A2 A0 81
C5A8:20 DD CC A9 C0 8D 41 C5 74
C5B0:8D 42 C5 A9 B0 8D 43 C5 EE
C5B8:A9 BC 8D 44 C5 4C 26 C6 B0
C5C0:A9 C0 8D 41 C5 8D 43 C5 C7
C5C8:A9 B0 8D 42 C5 A9 BC 8D 07
C5D0:44 C5 4C 26 C6 A2 A8 A0 8E
C5D8:A4 A9 A0 20 4C CE A2 A4 BE
C5E0:20 D0 CC 10 1F A2 98 20 20
C5E8:DD CC A2 A0 20 DD CC A9 B0
C5F0:BC 8D 41 C5 8D 42 C5 A9 6D
C5F8:AC 8D 43 C5 A9 C0 8D 44 B2
C600:C5 4C 26 C6 A9 BC 8D 41 51
C608:C5 8D 43 C5 A9 AC 8D 42 FD
C610:C5 A9 C0 8D 44 C5 4C 26 D3
C618:C6 AD 3F C5 10 08 20 71 0B
C620:C6 F0 03 4C 53 C6 AD 3F C2
C628:C5 2D 40 C5 29 7F D0 03 34
C630:20 F5 C4 EE 40 C5 AE 44 8D
C638:C5 A0 A0 8A 20 34 CD AE A9
C640:41 C5 A0 98 8A 20 34 CD 88
C648:AE 43 C5 AC 42 C5 20 D8 C3
C650:CC 30 C6 AD 3F C5 2D 40 AF
C658:C5 29 7F D0 03 20 F5 C4 59
C660:A9 00 8D C2 CF 8D C3 CF AC
C668:8D BE CF 8D BF CF 4C 02 17
C670:C5 20 9B C6 D0 24 AE 44 81
C678:C5 20 10 CD 20 9B C6 48 15
C680:AE 44 C5 20 19 CD 68 D0 D2
C688:11 AE 44 C5 20 19 CD 20 50
C690:9B C6 48 AE 44 C5 20 10 1B
C698:CD 68 60 20 AC C4 8A F0 B3
C6A0:03 20 C4 C8 60 20 02 C5 2A
C6A8:A9 00 8D 40 C5 8D B3 C6 53
C6B0:4C 45 C5 00 20 02 C5 A9 AC
C6B8:00 8D 40 C5 A9 01 8D B3 2E
C6C0:C6 AD 3F C5 29 7F 8D 3F 03
C6C8:C5 4C 45 C5 20 02 C5 4C 32
C6D0:F5 C4 20 02 C5 EE B3 C6 C6
C6D8:4C F5 C4 A9 00 8D C4 CF CC
C6E0:A9 01 8D C5 CF A9 00 8D 44
C6E8:C6 CF A9 00 8D C7 CF A2 D0
C6F0:C0 A0 C4 8A 20 4C CE A2 BA
C6F8:C4 20 52 CF A9 80 8D C6 69
C700:CF A2 C0 A0 C4 8A 20 34 07
C708:CD A9 00 8D C4 CF A9 01 7B
C710:8D C5 CF A9 00 8D C6 CF FF
C718:A9 00 8D C7 CF A2 BC A0 CD
C720:C4 8A 20 4C CE A2 C4 20 28
C728:52 CF A9 C7 8D C5 CF A9 53
C730:80 8D C6 CF A2 C4 A0 BC 5F
C738:98 20 94 CD A9 00 8D C2 B6
C740:CF 8D C3 CF 8D BE CF 8D 25
C748:BF CF A2 C4 20 52 CF A9 DF
C750:50 8D C5 CF A2 C4 20 DD 67
```

```
C758:CC A2 C0 A0 C4 20 D8 CC 3E
C760:30 42 A2 C4 20 52 CF EE 12
C768:C4 CF A9 90 8D C5 CF A2 52
C770:C4 A0 C0 20 D8 CC 30 2C 2B
C778:A2 C4 20 52 CF A9 32 8D CA
C780:C5 CF A2 C4 20 DD CC A2 3C
C788:BC A0 C4 20 D8 CC 30 14 A7
C790:A2 C4 20 52 CF A9 FA 8D 74
C798:C5 CF A2 C4 A0 BC 20 D8 B0
C7A0:CC 30 01 60 A9 09 4C A2 75
C7A8:C3 00 FF 20 23 C5 A2 C0 52
C7B0:20 52 CF EE C0 CF A9 3F A5
C7B8:8D C1 CF 20 CC FF A9 FF 35
C7C0:A8 A2 04 20 BA FF A9 00 F8
C7C8:20 BD FF 20 C0 FF A0 08 29
C7D0:20 04 C9 A2 BC 20 52 CF AF
C7D8:A0 0D 20 04 C9 20 20 C9 19
C7E0:A9 80 8D AA C7 A9 03 8D 3A
C7E8:A9 C7 20 C4 C8 F0 09 AD 59
C7F0:AA C7 0D A9 C7 8D AA C7 95
C7F8:A2 C0 20 19 CD 0E A9 C7 61
C800:0E A9 C7 90 E5 AC AA C7 04
C808:20 04 C9 20 04 C9 A2 BC 2F
C810:20 10 CD 20 E2 C8 30 17 23
C818:A2 C0 20 10 CD A2 C0 20 CA
C820:10 CD A2 C0 20 10 CD A2 0D
C828:C0 20 10 CD 4C E0 C7 A2 19
C830:BC 20 52 CF A2 C0 20 10 D7
C838:CD A0 0D 20 04 C9 20 20 24
C840:C9 A9 80 8D AA C7 A9 01 D2
C848:8D A9 C7 20 C4 C8 F0 09 3A
C850:AD AA C7 0D A9 C7 8D AA 5F
C858:C7 A2 C0 20 19 CD AD C0 AC
C860:CF 10 0D A2 C0 20 19 CD 30
C868:A2 C0 20 19 CD 4C 7D C8 74
C870:A9 01 CD A9 C7 2E A9 C7 7D
C878:2E A9 C7 90 CE AC AA C7 D3
C880:20 04 C9 20 04 C9 A2 BC A7
C888:20 10 CD 20 E2 C8 10 08 4C
C890:AD C0 CF 30 1A 4C D3 C7 97
C898:A2 C0 20 10 CD A2 C0 20 4B
C8A0:10 CD A2 C0 20 10 CD A2 8D
C8A8:C0 20 10 CD 4C 41 C8 A0 1B
C8B0:0D 20 04 C9 A0 0F 20 04 73
C8B8:C9 A9 FF 20 C3 FF 20 CC C6
C8C0:FF 4C 31 C5 A9 00 8D B3 04
C8C8:C6 20 55 C4 78 A5 01 29 42
C8D0:FE 85 01 B1 FB AA A5 01 55
C8D8:09 01 85 01 58 8A 2D 53 8A
C8E0:C4 60 A2 C4 20 52 CF A9 21
C8E8:C7 8D C5 CF A2 C4 A0 BC 9D
C8F0:4C D8 CC A2 C4 20 52 CF BD
C8F8:A9 05 8D C5 CF A2 C0 A0 D9
C900:C4 4C D8 CC A2 FF 20 C9 10
C908:FF B0 0B A5 CB C9 3F 18 9F
C910:F0 04 98 4C D2 FF B0 03 EF
C918:20 AF C8 A9 05 4C A2 C3 BD
C920:A0 1A 20 04 C9 A9 28 20 34
C928:D2 FF A9 80 4C D2 FF FF 10
C930:20 D1 C9 8A D0 01 60 20 95
C938:EE C9 A9 80 CD 2F C9 D0 82
C940:01 60 20 4D C9 20 77 C9 CC
C948:20 B2 C9 60 00 A9 00 85 04
C950:FB A9 D0 85 FC AD 4C C9 BF
C958:F0 07 18 A5 FC 69 08 85 A6
C960:FC AE 2F C9 CA 10 01 60 99
C968:18 A5 FB 69 08 85 FB 90 66
C970:02 E6 FC 4C 64 C9 FF A9 17
C978:28 8D 76 C9 A9 00 85 FD 45
C980:A0 08 4E 76 C9 90 04 18 48
C988:6D BD CF 4A 66 FD 88 D0 ED
C990:F1 85 FE 18 A5 FD 6D C1 A1
C998:CF 85 FD A5 FE 69 00 85 B2
C9A0:FE A0 03 06 FD 26 FE 88 AB
C9A8:D0 F9 18 A5 FE 69 A0 85 E4
C9B0:FE 60 78 A5 01 29 FB 85 6F
C9B8:01 A0 07 B1 FB AE ED C9 31
C9C0:F0 02 49 FF 91 FD 88 10 1C
C9C8:F2 A5 01 09 04 85 01 58 80
C9D0:60 A2 00 AD C0 CF D0 14 13
C9D8:AD C1 CF C9 28 B0 0D AD 16
C9E0:BC CF D0 08 AD BD CF C9 2F
C9E8:19 B0 01 E8 60 00 AD 2F 71
C9F0:C9 C9 20 B0 05 A9 80 4C 07
C9F8:34 CA C9 40 B0 03 4C 34 F4
CA00:CA C9 60 B0 06 38 E9 40 A9
CA08:4C 34 CA C9 80 B0 06 38 D1
CA10:E9 20 4C 34 CA C9 A0 B0 DE
CA18:05 A9 80 4C 34 CA C9 C0 90
CA20:B0 06 38 E9 40 4C 34 CA 9B
CA28:C9 FF B0 06 38 E9 80 4C CF
CA30:34 CA A9 5E AE 2F C9 E0 54
CA38:12 D0 08 A0 01 8C ED C9 F5
CA40:4C 64 CA E0 92 D0 08 A0 05
CA48:00 8C ED C9 4C 64 CA E0 C5
CA50:0E D0 08 A0 01 8C 4C C9 C8
CA58:4C 64 CA E0 8E D0 05 A0 F6
CA60:00 8C 4C C9 8D 2F C9 60 5C
CA68:20 D1 C9 8A D0 05 A9 0A 5C
CA70:4C A2 C3 38 A9 18 ED BD 18
CA78:CF 8D BD CF 60 FE 00 20 2D
CA80:68 CA A9 00 8D 7E CA 8D BB
CA88:7D CA AE 7D CA EC 28 C2 5A
CA90:90 06 AD 7E CA 85 FB 60 52
CA98:BD D0 CF 8D 2F C9 20 30 25
CAA0:C9 AD 2F C9 C9 80 F0 06 41
CAA8:EE C1 CF EE 7E CA EE 7D 89
CAB0:CA 4C 8A CA 20 68 CA A9 9E
CAB8:00 8D 7E CA 8D 7D CA AE D4
CAC0:7D CA EC 28 C2 90 06 AD F9
CAC8:7E CA 85 FB 60 BD D0 CF 2C
CAD0:8D 2F C9 20 30 C9 AD 2F 67
CAD8:C9 C9 80 F0 06 EE BD CF 1C
CAE0:EE 7E CA EE 7D CA 4C BF 45
CAE8:CA 20 23 C5 A9 00 8D B3 C8
CAF0:C6 AD 3F C5 29 7F 8D 3F 3B
CAF8:C5 20 37 CC B0 07 A9 0B 2D
CB00:85 FB 4C 31 C5 A9 00 85 50
CB08:FB A2 C0 A0 84 20 B2 CC 3F
CB10:A2 BC A0 80 20 B2 CC 20 C9
CB18:A1 CB A2 84 A0 C0 20 B2 0B
CB20:CC A2 80 A0 BC 20 B2 CC 79
CB28:A2 94 A0 84 20 B2 CC A2 9A
CB30:90 A0 80 20 B2 CC 20 A1 F4
CB38:CB 18 AD B9 CF 6D B5 CF 7C
CB40:8D 40 C5 20 45 C5 AD 89 8F
CB48:CF C9 FF F0 11 A2 8C A0 16
CB50:C0 20 B2 CC A2 88 A0 BC A8
CB58:20 B2 CC 4C 36 CB AD 81 C8
CB60:CF C9 FF D0 03 4C 31 C5 D0
CB68:A2 84 A0 C0 20 B2 CC A2 9A
CB70:80 A0 BC 20 B2 CC 20 A1 B4
CB78:CB 18 AD B9 CF 6D B5 CF BC
CB80:8D 40 C5 20 45 C5 AD 91 D7
CB88:CF C9 FF D0 03 4C 31 C5 F8
CB90:A2 94 A0 C0 20 B2 CC A2 C6
CB98:90 A0 BC 20 B2 CC 4C 76 12
CBA0:CB A5 CB C9 3F D0 05 68 4D
CBA8:68 4C 31 C5 20 02 C5 A9 48
CBB0:FF 8D 91 CF 8D 89 CF 20 2D
CBB8:E6 CB B0 01 60 A2 BC 20 04
CBC0:19 CD 20 E6 CB B0 F6 20 F9
CBC8:02 C5 A2 B0 A0 C0 20 B2 2D
CBD0:CC A2 AC A0 BC 20 B2 CC AF
CBD8:A2 BC 20 10 CD 20 E6 CB 7E
CBE0:B0 F6 20 02 C5 60 20 37 D9
CBE8:CC B0 02 18 60 AD 91 CF 81
CBF0:C9 FF D0 1D A2 C0 20 19 CA
CBF8:CD 20 37 CC 90 0E A2 C0 F5
CC00:A0 94 20 B2 CC A2 BC A0 49
CC08:90 20 B2 CC A2 C0 20 10 7D
CC10:CD AD 89 CF C9 FF D0 1D 37
CC18:A2 C0 20 10 CD 20 37 CC 62
CC20:90 0E A2 C0 A0 8C 20 B2 10
CC28:CC A2 BC A0 88 20 B2 CC 69
CC30:A2 C0 20 19 CD 38 60 20 11
CC38:AC C4 8A D0 02 18 60 20 09
CC40:C4 C8 F0 02 18 60 38 60 BF
CC48:20 95 CC 78 A5 01 29 FE FA
CC50:85 01 A9 00 85 FB A9 A0 32
CC58:85 FC A9 FB A2 FF A0 BF FE
CC60:20 D8 FF 08 A5 01 09 01 05
CC68:85 01 28 58 B0 08 20 B7 2D
CC70:FF 29 01 D0 01 60 A9 05 63
CC78:4C A2 C3 20 3B C4 20 95 1E
CC80:CC A9 00 20 D5 FF B0 08 05
CC88:20 B7 FF 29 02 D0 01 60 68
CC90:A9 05 4C A2 C3 A9 00 20 D8
CC98:90 FF 20 CC FF A9 FF A2 94
CCA0:08 A0 01 20 BA FF AD 28 E1
CCA8:C2 A2 D0 A0 CF 4C BD FF 9B
CCB0:FF FF 8E B0 CC 8C B1 CC EF
CCB8:A0 03 AE B0 CC BD 00 CF 71
CCC0:AE B1 CC 9D 00 CF EE B0 5F
CCC8:CC EE B1 CC 88 10 EB 60 44
CCD0:A0 C4 20 B2 CC 4C F6 CE 6F
CCD8:A9 C4 4C 94 CD 18 BD 03 98
CCE0:CF 49 FF 69 01 9D 03 CF 9F
CCE8:BD 02 CF 49 FF 69 00 9D B3
CCF0:02 CF BD 01 CF 49 FF 69 54
CCF8:00 9D 01 CF BD 00 CF 49 ED
CD00:FF 69 00 9D 00 CF 60 BD 8D
CD08:00 CF 10 03 20 DD CC 60 3C
CD10:20 22 CD A0 C4 8A 4C 34 25
CD18:CD 20 22 CD A0 C4 8A 4C 3D
CD20:94 CD A9 00 8D C4 CF 8D 5B
CD28:C5 CF 8D C6 CF 8D C7 CF CC
CD30:EE C5 CF 60 20 10 CF A0 36
CD38:00 AD CC CF 10 01 C8 AD 99
CD40:C8 CF 10 11 C8 C0 02 D0 65
CD48:0C A2 CC 20 DD CC A2 C8 5E
CD50:20 DD CC A0 02 18 AD CF B2
CD58:CF 6D CB CF 8D C7 CF AD 86
CD60:CE CF 6D CA CF 8D C6 CF C3
CD68:AD CD CF 6D C9 CF 8D C5 8D
CD70:CF AD CC CF 6D C8 CF 8D B1
CD78:C4 CF C0 01 F0 0E AD C4 72
CD80:CF 30 0C C0 00 F0 05 A2 0E
CD88:C4 20 DD CC 4C 23 CF A9 4F
CD90:06 4C A2 C3 20 10 CF A2 56
CD98:C8 20 DD CC 4C 37 CD FF 04
CDA0:00 00 FF FF 00 00 FF 20 5C
CDA8:10 CF 20 2F CF A9 00 8D E9
CDB0:9F CD 8D A0 CD 8D A1 CD 01
CDB8:8D A2 CD 8D A3 CD 8D A4 6A
CDC0:CD 8D A5 CD 8D A6 CD A0 7B
CDC8:20 4E C8 CF 6E C9 CF 6E C6
CDD0:CA CF 6E CB CF 90 25 18 73
CDD8:AD A2 CD 6D CF CF 8D A2 FF
CDE0:CD AD A1 CD 6D CE CF 8D B3
CDE8:A1 CD AD A0 CD 6D CD CF 18
CDF0:8D A0 CD AD 9F CD 6D CC EB
CDF8:CF 8D 9F CD 4E 9F CD 6E AB
CE00:A0 CD 6E A1 CD 6E A2 CD 84
CE08:6E A3 CD 6E A4 CD 6E A5 45
CE10:CD 6E A6 CD 88 D0 B2 AD 7C
CE18:9F CD D0 2B AD A0 CD D0 22
CE20:26 AD A1 CD 30 21 8D C4 33
CE28:CF AD A2 CD 8D C5 CF AD 1B
CE30:A3 CD 8D C6 CF AD A4 CD 7D
CE38:8D C7 CF E0 01 D0 05 A2 8E
CE40:C4 20 DD CC 4C 23 CF A9 09
CE48:06 4C A2 C3 20 10 CF A2 10
CE50:C8 20 D0 CC D0 05 A9 06 35
CE58:4C A2 C3 A9 00 8D 9F CD 1B
CE60:8D A0 CD 8D A1 CD 8D A2 81
CE68:CD A2 C4 20 52 CF 20 2F 71
CE70:CF A0 30 0E CF CF 2E CE ED
CE78:CF 2E CD CF 2E CC CF 2E B2
CE80:A2 CD 2E A1 CD 2E A0 CD F8
CE88:2E 9F CD AD 9F CD CD C8 52
CE90:CF D0 16 AD A0 CD CD C9 89
CE98:CF D0 0E AD A1 CD CD CA 99
CEA0:CF D0 06 AD A2 CD CD CB A9
CEA8:CF 90 24 AD A2 CD ED CB A5
CEB0:CF 8D A2 CD AD A1 CD ED 48
CEB8:CA CF 8D A1 CD AD A0 CD AF
CEC0:ED C9 CF 8D A0 CD AD 9F D1
CEC8:CD ED C8 CF 8D 9F CD 2E 93
CED0:C7 CF 2E C6 CF 2E C5 CF 0B
CED8:2E C4 CF B0 14 88 D0 93 BB
CEE0:AD C4 CF 30 0C E0 01 D0 3A
CEE8:05 A2 C4 20 DD CC 4C 23 2A
CEF0:CF A9 06 4C A2 C3 A2 03 D2
CEF8:BD C4 CF D0 06 CA 10 F8 22
CF00:A9 00 60 AD C4 CF 30 03 24
CF08:A9 01 60 A9 FF 60 FF FF E4
CF10:8C 0E CF 8D 0F CF A0 CC 12
CF18:20 B2 CC AE 0E CF A0 C8 B2
CF20:4C B2 CC A2 C4 AC 0F CF 1D
CF28:20 B2 CC 4C F6 CE FF A9 7F
CF30:00 AC CC CF 10 02 49 01 AD
CF38:AC C8 CF 10 02 49 01 8D 20
CF40:2E CF A2 CC 20 07 CD A2 67
CF48:C8 20 07 CD AD 2E CF AA 82
```

```
CF50:A8 60 A9 00 A0 04 9D 00 E1
CF58:CF E8 88 D0 F9 60 FF FF 89
CF60:00 00 FF FF 00 00 FF FF FF
CF68:00 00 FF FF 00 00 FF FF 08
CF70:00 00 7F FF 00 01 7F FF 03
CF78:00 00 FF FF 10 01 FF FF 9C
CF80:0D 44 47 52 41 50 48 20 C1
CF88:42 59 20 44 41 4E 20 43 AE
CF90:4F 59 20 31 31 2F 38 36 32
CF98:0D 20 CC FF A2 00 BD 80 71
CFA0:CF 20 D2 FF E8 E0 19 D0 58
CFA8:F5 60 FF FF 00 00 FF FF 5B
```

Program 2: DGraph Loader

```
HE 10 REM COPYRIGHT 1988 COMPU
      TE! PUBLICATIONS, INC. -
      ALL RIGHTS RESERVED
RH 20 PRINT"{CLR}{3 SPACES}COP
      YRIGHT 1988 COMPUTE! PUB
      ., INC."
CA 30 PRINTTAB(11)"ALL RIGHTS
      {SPACE}RESERVED"
AX 40 IFL=0THENL=1:LOAD"DGRAPH
      .OBJ",8,1
FX 50 PRINT"{DOWN}DGRAPH1.1 IS
      ACTIVE.{DOWN}"
XS 60 SYS49158:@4,0,0:NEW
```

Program 3: Demo 1

```
XF 10 @3:@2:POKE50913,1:POKE50
      959,1:POKE50918,0:POKE50
      964,0:POKE50923,0:POKE50
      969,0
CE 20 X1%=0:X2%=320
RM 30 FORY=0TO200STEP8
EB 50 Y1%=Y:Y2%=200-Y
FB 60 @4,X1%,Y2%:@7,X2%,Y1%,0
CX 70 NEXTY
KK 80 Y1%=0:Y2%=200
HQ 90 FORX=320TO0STEP-10
MF 100 X1%=X:X2%=320-X
EP 110 @4,X2%,Y1%:@7,X1%,Y2%,0
BE 120 NEXTX
XC 130 @4,0,0:@7,319,0,0:@7,31
      9,199,0
XX 140 @7,0,199,0:@7,0,0,0
QP 145 FORN=0TO50
GB 150 C1%=16*RND(0):C2%=16*RN
      D(0)
AM 160 IF(C1%=C2%)GOTO150
DH 170 POKE646,C1%:POKE53281,C
      2%
JG 180 FORI=0TO100:NEXT
FE 190 NEXTN
AF 200 POKE53281,6:PRINT"{WHT}
      {CLR}PRINT BURST PATTER
      N (Y/N)?":@1
DH 210 GETC$:IF(C$="")GOTO210
MG 220 IF(C$<>"Y")THENPRINT"
      {CLR}":END
PX 230 @2:@14:PRINT"{CLR}":@1:
      END
```

Program 4: Demo 2

```
KK 5 POKE50913,1:POKE50959,1:P
     OKE50918,0:POKE50964,0:PO
     KE50923,0:POKE50969,0
XF 10 POKE53281,6:PRINT"{WHT}"
      ;:@3:@2
CC 20 @4,20,50:@7,20,150,0
MB 30 @4,300,50:@7,300,150,0
XH 50 PH=∏*3/4
PX 60 FORJ=0TO31
DF 70 AG=∏*J/16
QP 80 Y1%=COS(AG)*50+100:Y2%=C
      OS(AG+PH)*50+100
CC 90 @4,20,Y1%:@7,300,Y2%,0
JQ 100 NEXTJ
RM 110 @4,0,0:@7,319,0,0:@7,31
      9,199,0:@7,0,199,0:@7,0
      ,0,0
DK 115 FORI=0TO2500:NEXTI
PD 120 PRINT"{CLR}PRINT TWIST
      {SPACE}PATTERN (Y/N)?":
      @1
XE 130 GETC$:IF(C$="")GOTO130
MP 140 IF(C$<>"Y")THENPRINT"
      {CLR}":END
ED 150 @2:@14:PRINT"{CLR}":@1:
      END
```

Program 5: Demo 3

```
FH 5 REM******* SCALE = 319 BY
     239 ********
KC 10 REM**********************
      *************
HG 20 REM**** BUILD TITLES AND
      OUTLINE ****
XD 30 REM**********************
      *************
DE 40 REM
GG 41 POKE50913,1:POKE50959,1
DB 42 POKE50918,0:POKE50964,51
PF 43 POKE50923,0:POKE50969,11
      7
PK 50 PRINTCHR$(8)+CHR$(14):@2
      :@3
DC 60 @4,0,116:@7,319,116,0:@8
      ,0,116,13
FM 70 @4,159,0:@7,159,239,0:@8
      ,159,0,13
DQ 80 @4,319,239:@7,319,0,0
CE 90 @7,0,0,0:@7,0,239,0
RC 100 CH$=CHR$(14)+CHR$(18)+"
      {6 SPACES}DGRAPH DEMO B
      Y DAN COY 5/87
      {7 SPACES}"
BJ 110 @10,0,24,CH$
GR 120 CH$=CHR$(146)+"LINES:"
JG 130 @10,1,23,CH$:@10,1,22,"
      {6 T}"
GG 140 @10,1,11,"FILLS:":@10,1
      ,10,"{6 T}"
BR 150 @10,21,23,"TEXT:":@10,2
      1,22,"{5 T}"
JE 160 @10,21,11,"GRAPHICS:":@
      10,21,10,"{9 T}"
SE 170 REM
JF 180 REM**********************
      *************
EH 190 REM*** DRAW EXAMPLE LIN
      E STYLES ****
RF 200 REM**********************
      *************
DG 210 REM
AG 220 FORI=0 TO 8
EF 230 S%=I:Y%=215-(5*I)
KE 240 @4,20,Y%:@7,140,Y%,S%
AF 250 NEXT I
FH 260 FORI=9 TO 17
SE 270 S%=I:Y%=210-(5*I)
AP 280 @4,140,Y%:@7,20,Y%,0:@8
      ,140,Y%,S%
AJ 290 NEXT I
JP 300 REM
DR 310 REM**********************
      *************
DD 320 REM****** DRAW FILL EXA
      MPLES *******
PS 330 REM**********************
      *************
JS 340 REM
RD 350 @4,20,15:@7,140,15,0:@7
      ,140,100,0
CH 360 @7,20,100,0:@7,20,15,0
FK 370 @4,40,35:@7,120,35,0:@7
      ,120,80,0
XB 380 @7,40,80,0:@7,40,35,0
RQ 390 @4,80,35:@7,80,80,0:@7,
      120,35,0
HC 400 @4,40,58:@7,80,58,0
QR 410 @9,60,65,0:@9,60,45,1
AP 420 @9,90,45,4:@9,110,70,7
PS 430 @9,80,20,8:@9,80,90,8
MF 440 REM**********************
      *************
QX 450 REM***** PRINT TEXT CRO
      SSWORD ******
CH 460 REM**********************
      *************
AH 470 REM
HJ 480 CH$=CHR$(142)+CHR$(146)
      +"UPPERCASE"
PG 490 @11,27,21,CH$
SP 500 FOR I=0TO150:NEXT I
RQ 510 CH$=CHR$(14)+"LOWERCASE
      "
SJ 520 @10,29,21,CH$
CK 530 FOR I=0TO150:NEXT I
QA 540 CH$=CHR$(142)+CHR$(18)+
      "REVERSE"
EP 550 @10,26,13,CH$
GX 560 FOR I=0TO150:NEXT I
EQ 570 CH$=CHR$(146)+"NORMAL"
HR 580 @10,23,15,CH$
MQ 590 FOR I=0TO150:NEXT I
EG 600 @10,25,17,"HORIZONTAL"
XQ 610 FOR I=0TO150:NEXT I
PM 620 @11,33,23,"VERTICAL"
GD 630 FOR I=0TO150:NEXT I
HC 640 REM**********************
      *************
QJ 650 REM******** DRAW SPACES
      HIP *********
XD 660 REM**********************
      *************
KE 670 REM
MF 680 RO=∏/6:EL=∏/12
FP 690 YC=0:ZC=0:RC=10
PR 700 FORI=-50TO10STEP20
RC 710 XC=I:GOSUB1000
RD 720 NEXTI
EX 730 XC=20:RC=8:GOSUB1000
JA 740 XC=40:YC=0:ZC=30:RC=40:
      GOSUB1200
RQ 750 ZC=35:GOSUB1200
BS 760 ZC=33:RC=5
FJ 770 FORI=-70TO-10STEP20
XP 780 XC=I:YC=33:GOSUB1000:YC
      =-33:GOSUB1000
KJ 790 NEXT I
FM 795 FORI=0TO5
CC 800 AG=∏*I/3:XC=-50:YC=0:ZC
      =0:RC=0:GOSUB1400:@4,X%
      ,Y%
KP 805 RC=10:GOSUB1400:@7,X%,Y
      %,0:XC=10:GOSUB1400:@7,
      X%,Y%,0
HS 810 RC=0:GOSUB1400:@7,X%,Y%
      ,0:XC=20:RC=8:GOSUB1400
      :@7,X%,Y%,0
AK 815 NEXT I
JP 820 FORI=0TO5
FK 825 AG=∏*(I/3+1/6):XC=40:YC
      =0:ZC=30:RC=0:GOSUB1600
      :@4,X%,Y%
DR 830 RC=40:GOSUB1600:@7,X%,Y
      %,0:ZC=35:GOSUB1600:@7,
      X%,Y%,0
BG 835 RC=0:GOSUB1600:@7,X%,Y%
      ,0
AM 840 NEXT I
ER 845 FORI=0TO3
RP 850 AG=∏*I/2:XC=-70:YC=33:Z
      C=33:RC=0:GOSUB1400:@4,
      X%,Y%
ES 855 RC=5:GOSUB1400:@7,X%,Y%
      ,0:XC=-10:GOSUB1400:@7,
      X%,Y%,0
XG 860 RC=0:GOSUB1400:@7,X%,Y%
      ,0
HP 865 XC=-70:YC=-33:ZC=33:RC=
      0:GOSUB1400:@4,X%,Y%
```

```
AS 870 RC=5:GOSUB1400:@7,X%,Y%
       ,0:XC=-10:GOSUB1400:@7,
       X%,Y%,0
XA 875 RC=0:GOSUB1400:@7,X%,Y%
       ,0
AR 880 NEXT I
SK 885 X=10:Y=0:Z=10:GOSUB2000
       :@4,X%,Y%
XH 890 X=30:Z=30:GOSUB2000:@7,
       X%,Y%,0
AP 895 X=10:GOSUB2000:@7,X%,Y%
       ,0
PR 900 X=-10:Z=10:GOSUB2000:@7
       ,X%,Y%,0
PP 905 X=10:GOSUB2000:@7,X%,Y%
       ,0
GM 910 X=-20:Y=7:Z=7:GOSUB2000
       :@4,X%,Y%
CC 915 Y=26:Z=29:GOSUB2000:@7,
       X%,Y%,0
HC 920 X=-30:GOSUB2000:@7,X%,Y
       %,0
XG 925 Y=7:Z=7:GOSUB2000:@7,X%
       ,Y%,0
QC 930 X=-20:GOSUB2000:@7,X%,Y
       %,0
MM 935 X=-20:Y=-7:Z=7:GOSUB200
       0:@4,X%,Y%
EP 940 Y=-26:Z=29:GOSUB2000:@7
       ,X%,Y%,0
PA 945 X=-30:GOSUB2000:@7,X%,Y
       %,0
XC 950 Y=-7:Z=7:GOSUB2000:@7,X
       %,Y%,0
AB 955 X=-20:GOSUB2000:@7,X%,Y
       %,0
XG 960 REM**********************
       ************
EG 963 REM***** SAVE, LOAD, AN
       D PRINT *****
PH 965 REM**********************
       ************
FH 966 REM
XF 968 FORI=0TO2500:NEXTI
MR 970 PRINT"{CLR}SAVING DEMOM
       STRATION SCREEN TO DISK
       ...":@1:@12,"DEMO.DAT"
PE 975 @3:@2:@13,"DEMO.DAT":OP
       EN8,8,15,"S:DEMO.DAT":C
       LOSE8:FORI=0TO2500:NEXT
       I
HA 980 PRINT"{CLR}PRINT DEMONS
       TRATION SCREEN (Y/N)?":
       @1
SP 983 GETC$:IF(C$="")GOTO983
GP 986 IF(C$<>"Y")THENPRINT"
       {CLR}":END
FK 988 @2:@14:PRINT"{CLR}":@1:
       END
QB 1000 DC=↑/4:X=XC:Y=YC:Z=ZC+
        RC
EQ 1010 GOSUB2000:@4,X%,Y%
KC 1020 FOR AG=DCTO(2*↑+DC)STE
        PDC
JH 1030 Y=YC+RC*SIN(AG):Z=ZC+R
        C*COS(AG)
GJ 1040 GOSUB2000:@7,X%,Y%,0
GF 1050 NEXT AG
FC 1060 RETURN
MF 1200 DC=↑/12:Y=YC:Z=ZC:X=XC
        +RC
KX 1210 GOSUB2000:@4,X%,Y%
GG 1220 FOR AG=DCTO(2*↑+DC)STE
        PDC
XB 1230 X=XC+RC*COS(AG):Y=YC+R
        C*SIN(AG)
KQ 1240 GOSUB2000:@7,X%,Y%,0
FA 1250 NEXT AG
KS 1260 RETURN
AH 1400 X=XC:Y=YC+RC*SIN(AG):Z
        =ZC+RC*COS(AG):GOTO200
        0
HB 1600 Z=ZC:X=XC+RC*COS(AG):Y
        =YC+RC*SIN(AG):GOTO200
        0
HD 2000 SR=SIN(RO):CR=COS(RO)
SE 2010 SE=SIN(EL):CE=COS(EL)
BE 2020 X%=X*CR-Y*SR+242
QH 2030 Y%=Z*CE-(Y*CR+X*SR)*SE
        +30
JB 2040 RETURN
```

Program 6: DGraph Painter

```
XH 10 PRINTCHR$(14);CHR$(8):LX
      %=4:LY%=195
SC 20 POKE50913,1:POKE50959,1:
      POKE50918,0
PE 30 POKE50964,0:POKE50923,0:
      POKE50969,0
JG 40 @2:X%=4:Y%=195
CH 50 IF X%<0 THEN X%=319
EB 60 IF X%>319 THEN X%=0
CQ 70 IF Y%<0 THEN Y%=199
MJ 80 IF Y%>199 THEN Y%=0
DB 90 C1%=5:C2%=6:@4,X%,Y%:IF(
      PEEK(251)<>0)THENC1%=6:C
      2%=5
PQ 100 @C1%,X%,Y%
QQ 110 XT%=PEEK(56320)AND31
MP 120 JX%=SGN(XT%AND4)-SGN(XT
       %AND8)
XQ 130 JY%=SGN(XT%AND2)-SGN(XT
       %AND1)
FP 140 JF%=1-SGN(XT%AND16)
SS 150 IF(JX%<>0)OR(JY%<>0)GOT
       O200
XS 160 GETC$:C%=PEEK(653)AND4
EF 170 IF(C$="")AND(C%=0)GOTO1
       10
GF 180 IF(C%=0)GOTO220
HC 190 GOTO380
CD 200 IF(JF%<>0)THENC2%=C1%
CK 210 @C2%,X%,Y%:X%=X%+JX%:Y%
       =Y%+JY%:GOTO50
JQ 220 CX%=X%/8:CY%=Y%/8:@10,C
       X%,CY%,C$
EA 230 IF(PEEK(251)=0)GOTO260
EQ 240 IF(CX%>38)THENX%=-4:IF(
       CY%>0)THENY%=Y%-8
JF 250 X%=X%+8:GOTO50
JD 260 C%=ASC(C$):IF(C%<>13)GO
       TO290
RC 270 @C2%,X%,Y%:X%=4:IF(Y%>7
       )THENY%=Y%-8
GG 280 GOTO50
SQ 290 IF(C%=29)THENJX%=8:GOTO
       210
GR 300 IF(C%=157)THENJX%=-8:GO
       TO210
QX 310 IF(C%=145)THENJY%=8:GOT
       O210
GS 320 IF(C%=17)THENJY%=-8:GOT
       O210
XG 330 IF(C%=19)THEN@C2%,X%,Y%
       :X%=4:Y%=195:GOTO50
GE 340 IF(C%=147)THEN@3:X%=4:Y
       %=195:GOTO50
FS 350 IF(C%<>20)GOTO110
GC 360 @C2%,X%,Y%:IF(X%>7)THEN
       X%=X%-8:CX%=X%/8:CY%=Y%
       /8:@10,CX%,CY%," "
XQ 370 GOTO50
QD 380 PRINT"{CLR}";
JB 390 PRINT"{RVS}{16 SPACES}O
       PTIONS{17 SPACES}{OFF}"
       ;
XP 400 PRINT"{DOWN} G -> GET A
        FILE"
EG 410 PRINT" S -> SAVE A FILE
       "
JF 420 PRINT" P -> PRINT SCREE
       N"
JC 430 PRINT" D -> DRAW A LINE
       "
HJ 440 PRINT" F -> FILL A REGU
       LAR POLYGON"
JR 450 PRINT" U -> UPPERCASE"
CF 460 PRINT" L -> LOWERCASE"
SS 470 PRINT" N -> NORMAL CHAR
       ACTERS"
QJ 480 PRINT" R -> REVERSE CHA
       RACTERS"
DD 490 PRINT" C -> CLEAR SCREE
       N"
QB 500 PRINT" Q -> QUIT"
CK 510 PRINT"{DOWN}{RVS}ENTER
       {SPACE}OPTION:{OFF} ";:
       @1
MK 520 GETC$:IF(C$="")GOTO520
MG 530 PRINTC$+"{DOWN}"
DE 540 IF(C$<>"G")GOTO580
QQ 550 C$="":INPUT"GET FILENAM
       E";C$
QJ 560 IF(C$="")THENPRINT"
       {CLR}{DOWN}GET A FILE A
       BORTED -- ENTER COMMAND
       {DOWN}":GOTO390
KP 570 PRINT"{DOWN}GETTING FIL
       E...":@13,C$:@2:GOTO50
JX 580 IF(C$<>"S")GOTO620
BE 590 C$="":INPUT"SAVE FILENA
       ME";C$
PR 600 IF(C$="")THENPRINT"
       {CLR}{DOWN}SAVE A FILE
       {SPACE}ABORTED -- ENTER
        COMMAND{DOWN}":GOTO390
QS 610 PRINT"{DOWN}SAVING FILE
       ...":@C2%,X%,Y%:@12,C$:
       @C1%,X%,Y%:@2:GOTO110
EB 620 IF(C$<>"P")GOTO670
EB 630 PRINT"SURE PRINT (Y/N)?
       "
KR 640 GETC$:IF(C$="")GOTO640
AH 650 IF(C$<>"Y")THENPRINT"
       {CLR}{DOWN}PRINT ABORTE
       D -- ENTER COMMAND
       {DOWN}":GOTO390
AK 660 PRINT"{DOWN}PRINTING...
       ":@C2%,X%,Y%:@14:@C1%,X
       %,Y%:@2:GOTO110
FE 670 IF(C$<>"D")GOTO800
KR 680 PRINT"{RVS}{14 SPACES}D
       RAW OPTIONS{14 SPACES}
       {OFF}"
HS 690 PRINT" S -> SET STARTIN
       G POINT"
GK 700 PRINT" D -> DRAW THE LI
       NE"
PH 710 PRINT"{DOWN}{RVS}ENTER
       {SPACE}DRAW OPTION:
       {OFF} ";
FJ 720 GETC$:IF(C$="")GOTO720
RA 730 PRINTC$
EX 740 IF(C$<>"S")GOTO760
KQ 750 LX%=X%:LY%=Y%:C2%=C1%:@
       2:GOTO110
BD 760 IF(C$<>"D")THENPRINT"
       {CLR}{DOWN}LINE ABORTED
        -- ENTER COMMAND{DOWN}
       ":GOTO390
RM 770 S%=256:INPUT"{DOWN}LINE
        STYLE (0-255)";S%
DX 780 IF((S%<0)OR(S%>255))THE
       NPRINT"{CLR}{DOWN}DRAW
       {SPACE}LINE ABORTED --
       {SPACE}ENTER COMMAND
       {DOWN}":GOTO390
BA 790 @2:@4,LX%,LY%:@7,X%,Y%,
       S%:LX%=X%:LY%=Y%:GOTO50
JK 800 IF(C$<>"F")GOTO880
EE 810 PRINT"IS MARKER IN POLY
       GON (Y/N)? ";
JA 820 GETC$:IF(C$="")GOTO820
AK 830 PRINTC$
BX 840 IF(C$<>"Y")THENPRINT"
       {CLR}{DOWN}FILL ABORTED
```

```
        -- ENTER COMMAND{DOWN}
        ":GOTO390
RM  850 S%=128:INPUT"{DOWN}FILL
        STYLE (0-127)";S%
HH  860 IF((S%<0)OR(S%>127))THE
        NPRINT"{CLR}{DOWN}FILL
        {SPACE}ABORTED -- ENTER
        COMMAND{DOWN}":GOTO390
EG  870 @2:@6,X%,Y%:@9,X%,Y%,S%
        :GOTO50
EM  880 IF(C$="U")THENC$=CHR$(1
        42):@10,0,0,C$:@2:GOTO1
        10
AM  890 IF(C$="L")THENC$=CHR$(1
        4):@10,0,0,C$:@2:GOTO11
        0
QK  900 IF(C$="N")THENC$=CHR$(1
        46):@10,0,0,C$:@2:GOTO1
        10
SG  910 IF(C$="R")THENC$=CHR$(1
        8):@10,0,0,C$:@2:GOTO11
        0
PM  920 IF(C$="C")THEN@3:@2:GOT
        O110
DC  930 PRINT"{RVS}{14 SPACES}Q
        UIT OPTIONS{14 SPACES}
        {OFF}"
PX  940 PRINT" J -> RETURN TO J
        OY"
HX  950 PRINT" B -> GO TO BASIC
        "
XB  960 PRINT"{DOWN}{RVS}ENTER
        {SPACE}QUIT OPTION:
        {OFF}"
PD  970 GETC$:IF(C$="")GOTO970
HG  980 IF(C$="J")THEN@2:GOTO11
        0
CS  990 IF(C$="B")THEN@C2%,X%,Y
        %:PRINT"{CLR}{TAB}":@1:
        PRINTCHR$(142);CHR$(9):
        END
MC 1000 PRINT"{CLR}{DOWN}QUIT
        {SPACE}ABORTED -- ENTE
        R COMMAND{DOWN}":GOTO3
        90
```

BEFORE TYPING . . .

Before typing in programs, please refer to "How to Type In COMPUTE!'s GAZETTE Programs," elsewhere in this issue.

Spy Defense

See program listing on page 24 before typing in.

```
0801:0D 08 12 0E 9E 20 32 30 C6
0809:36 33 11 00 00 00 20 0B 6E
0811:0B 20 12 0A 20 A6 08 20 5D
0819:64 08 F0 F5 20 D8 0D 20 79
0821:41 0D 20 9E 0C 20 62 0E B6
0829:20 3E 10 20 2B 11 20 30 EA
0831:0F 20 F8 0C 20 3C 08 F0 A3
0839:D5 D0 DC AC 09 D0 C0 DC B8
0841:90 4E A9 8F A0 13 A2 07 F8
0849:20 2B 13 A9 1F 8D 12 05 89
0851:A2 FF 0E 0E 05 AD 15 D0 2F
0859:29 EF 8D 15 D0 20 22 13 5B
0861:4C 22 13 A6 FE A0 0A AD 29
0869:2B D0 4A B0 02 A0 09 E0 1D
0871:42 90 04 20 C8 0B A8 E0 ED
0879:28 B0 02 A0 0B 8C 2B D0 C5
0881:20 E4 FF C9 03 F0 0A AC 14
0889:8D 02 C0 01 F0 D5 C9 85 01
0891:60 78 A9 31 8D 14 03 A9 A4
0899:EA 8D 15 03 58 A9 04 8D 54
08A1:88 02 68 68 00 A2 00 E8 7D
08A9:E0 04 B0 0A BD BC 04 C9 94
08B1:03 F0 F4 FE BC 04 A5 27 76
08B9:C9 0B B0 04 C6 A9 C6 A9 DB
08C1:A2 09 BD C5 15 9D 25 D0 B3
08C9:BD CF 15 9D F8 87 CA 10 B4
08D1:F1 A9 90 8D 15 D0 A9 10 7F
08D9:8D 1C D0 8D 17 D0 8D 1D DE
08E1:D0 A9 A0 8D 08 D0 A9 6A F2
08E9:8D 09 D0 A9 19 8D 0E D0 A3
08F1:A9 CC 8D 0F D0 18 20 1B EE
08F9:0F A9 00 8D 10 D0 A8 A2 8C
0901:03 99 B4 04 96 F7 99 AA 44
0909:00 C8 C0 04 D0 F3 20 1C 58
0911:14 CA 8A 4A 69 03 85 B5 ED
0919:A5 27 C9 08 08 29 07 AA 1F
0921:A9 00 28 B0 03 BD DE 16 FA
0929:8D 20 D0 BD EE 16 8D 23 0E
0931:D0 BD E6 16 8D 21 D0 AD 99
0939:20 D0 8D 22 D0 A9 0F 8D 3C
0941:24 D0 20 40 0B A9 84 85 2F
0949:A5 A9 28 85 A4 AA A9 60 79
0951:18 20 D4 09 AD 23 D0 85 C3
0959:26 A9 87 85 A5 A9 20 85 CB
0961:A4 A5 27 C9 05 90 02 A9 C8
0969:05 0A 85 AE A9 10 E5 AE 24
0971:8D 00 04 A8 A2 17 18 20 17
0979:F0 FF A5 AE 18 69 05 85 99
0981:02 85 BF A9 DA A0 16 20 2E
0989:D0 0B C6 02 D0 F5 A9 0D 7E
0991:38 E5 AE 85 AE A8 C8 C8 D9
0999:A6 AE A9 1C 18 20 D4 09 95
09A1:A5 AE 0A 85 AF A5 A4 18 41
09A9:69 28 38 E5 AF C5 A4 B0 6E
09B1:02 E6 A5 85 A4 A6 AE A9 52
09B9:1C 18 20 D4 09 C4 AE 90 7A
09C1:09 F0 04 E6 AE D0 D1 88 68
09C9:D0 CE A9 00 85 26 A2 28 5F
09D1:A9 1C 18 08 84 B1 86 AE E9
09D9:A0 28 B0 02 A0 01 8C 79 18
09E1:05 48 20 FC 09 A5 A4 18 9C
09E9:6D 79 05 85 A4 90 02 E6 5C
09F1:A5 68 CA D0 EC A4 B1 A6 5B
09F9:AE 28 60 48 A0 00 91 A4 CA
0A01:A5 A5 48 18 69 54 85 A5 29
0A09:A5 26 91 A4 68 85 A5 68 03
0A11:60 A9 3F 8D 02 DD A9 C5 21
0A19:8D 00 DD A9 84 8D 88 02 B7
0A21:A9 99 85 A4 A9 14 85 A5 B9
0A29:A9 00 85 AE A9 B2 85 AF 80
0A31:A0 00 B1 A4 C9 ED F0 23 21
0A39:A2 00 C9 E7 D0 03 8A A2 A0
0A41:07 C9 EF D0 03 8A A2 0F EC
0A49:E6 A4 D0 02 E6 A5 91 AE D3
0A51:E6 AE D0 02 E6 AF CA 10 5A
0A59:F5 30 D7 A0 00 8C 0E DC A4
0A61:A9 33 85 01 84 A4 84 49 E0
0A69:A9 D0 85 A5 A9 B0 85 4A F6
0A71:B1 A4 91 49 C8 D0 F9 E6 B2
0A79:A5 E6 4A A5 A5 C9 D2 D0 88
0A81:EF A9 37 85 01 A9 01 8D 75
0A89:0E DC 20 DE 0A A9 1D 8D 8C
0A91:18 D0 A9 5B 8D 11 D0 A9 CC
0A99:00 85 FB 85 FC 85 FD 85 66
0AA1:FE 8D BE 04 8D BF 04 A0 C4
0AA9:18 99 00 D4 88 10 FA A9 A1
0AB1:0F 8D 18 D4 A9 01 85 27 84
0AB9:BD BC 04 8D BD 04 A9 2C 9A
0AC1:85 A9 A9 03 85 A7 A9 05 8B
0AC9:8D 33 17 78 A9 25 8D 14 EC
0AD1:03 A9 14 8D 15 03 58 A9 3C
0AD9:04 8D 19 D0 60 A0 07 A9 C0
0AE1:FF AA 99 40 B1 48 8A 99 35
0AE9:48 B1 0A AA 68 4A 88 10 08
0AF1:F1 A0 07 A9 FF 99 E0 B0 7B
0AF9:C0 02 90 02 A9 00 99 F8 9A
0B01:B0 A9 18 99 58 B1 88 10 21
0B09:EA 60 A9 01 8D 21 D0 A9 2E
0B11:00 8D 20 D0 A9 1B 8D 11 81
0B19:D0 A9 15 8D 18 D0 A9 00 D4
0B21:8D 15 D0 20 40 0B A2 04 D6
0B29:A0 0E 18 20 F0 FF A9 D7 CA
0B31:A0 15 20 D0 0B 20 64 08 97
0B39:F0 05 20 3A 0D D0 F6 A9 F3
0B41:2A A0 16 20 D0 0B A2 0F 60
0B49:8A 48 A9 66 A0 16 20 D0 C0
0B51:0B 68 4A 90 0D 48 A0 02 26
0B59:B9 FB 00 20 A8 0B 88 10 DF
0B61:F7 68 4A 90 1C 48 A0 14 37
0B69:A2 00 18 20 F0 FF A6 FE A9
0B71:E0 64 90 04 A2 64 D0 05 B0
0B79:A9 30 20 D2 FF 20 BA 0B A2
0B81:68 4A 90 0F 48 A0 1D A2 03
0B89:00 18 20 F0 FF A6 27 20 C1
0B91:BA 0B 68 4A 90 38 A0 27 47
0B99:A2 00 18 20 F0 FF A5 A7 80
0BA1:29 0F 09 30 4C D2 FF 48 2A
0BA9:4A 4A 4A 4A 09 30 20 D2 81
0BB1:FF 68 29 0F 09 30 4C D2 6C
0BB9:FF E0 0A B0 05 A9 30 20 A3
0BC1:D2 FF A9 00 4C CD BD A5 31
0BC9:A2 49 FF 4D 12 D0 60 85 72
0BD1:49 84 4A A0 00 B1 49 F0 4B
0BD9:06 20 D2 FF C8 D0 F6 60 2D
0BE1:A9 84 85 A5 BD F7 0F 2D 12
0BE9:10 D0 F0 02 A9 20 48 8A 63
0BF1:0A AA BC 01 D0 BD 00 D0 AD
0BF9:4A 4A 4A 85 A6 E0 08 F0 23
0C01:04 C6 A6 C6 A6 68 18 65 7A
0C09:A6 85 A4 98 38 E9 1F 4A E5
0C11:4A 4A AA A5 A4 18 69 28 11
0C19:85 A4 90 02 E6 A5 CA D0 83
0C21:F2 60 48 AD 10 D0 25 B1 6E
0C29:85 02 68 4A B0 01 88 4A 1B
0C31:B0 01 C8 4A B0 23 48 A5 E7
0C39:02 D0 14 A5 B1 C9 20 B0 09
0C41:04 A9 19 D0 02 A9 0A 85 46
0C49:AE E6 AE E4 AE 90 09 CA 2B
0C51:E0 FF D0 04 A9 00 85 02 8E
0C59:68 4A B0 1F A5 02 F0 14 6B
0C61:A5 B1 C9 20 B0 04 A9 27 04
0C69:D0 02 A9 5A 85 AE E6 AE A8
0C71:E4 AE B0 07 E8 D0 04 A5 66
0C79:B1 85 02 A5 B1 C9 10 D0 0C
0C81:09 46 41 B0 05 C8 A5 40 B9
0C89:85 41 C0 41 B0 02 A0 41 F0
0C91:A5 B1 49 FF 2D 10 D0 05 62
0C99:02 8D 10 D0 60 20 3A 0D 2A
0CA1:F0 04 A9 00 85 B0 A5 A7 4A
0CA9:2A 90 10 A9 9F A2 04 20 47
0CB1:3D 12 90 06 A5 A7 29 7F FC
0CB9:85 A7 60 98 29 1F C9 0D 7A
0CC1:D0 F8 A5 B0 D0 F4 A5 A7 8D
0CC9:A8 29 0F D0 11 AD 15 05 DD
0CD1:10 E8 A9 6F A0 13 A2 0E FC
0CD9:86 B0 20 2B 13 60 A5 AC 2A
0CE1:30 D8 98 09 80 85 A7 C6 1C
0CE9:A7 A2 08 86 B0 20 49 0B 8B
0CF1:A9 9F A2 04 4C 21 12 A2 09
0CF9:03 B5 F7 D0 16 A9 2B 20 DA
0D01:3D 12 90 25 A5 27 C9 0B 0B
0D09:90 02 A9 0A 0A 49 1F 95 0B
0D11:F7 D0 16 BD B4 04 C9 03 46
0D19:D0 0F A5 A8 C9 02 B0 09 5F
0D21:D6 F7 D0 05 A9 2B 20 21 6A
0D29:12 A9 00 A0 0C C4 27 2A AC
0D31:8D 36 0D CA E0 01 D0 C1 5C
0D39:60 AD 00 DC A8 29 10 60 27
0D41:A9 40 85 B1 AD 15 D0 29 98
0D49:40 F0 24 E6 A3 A5 A3 29 D6
0D51:07 C9 04 B0 19 AE 0C D0 59
0D59:A5 BC 20 23 0C EC 0C D0 A8
0D61:F0 04 8E 0C D0 60 AD 15 FF
0D69:D0 29 BF 8D 15 D0 60 20 D3
0D71:3A 0D D0 FA A5 B0 D0 F6 3E
0D79:A2 0B 98 4A 4A 4A 90 05 01
0D81:A2 07 4A B0 E9 86 BC 86 6C
0D89:B0 A9 A9 4F A0 13 A2 00 20 9D
0D91:2B 13 AD 10 D0 29 10 F0 F8
0D99:02 A9 40 85 02 A6 BC E0 84
0DA1:0B F0 23 AD 08 D0 18 69 D9
0DA9:33 8D 0C D0 90 04 A9 40 77
0DB1:85 02 AD 09 D0 18 69 07 16
0DB9:8D 0D D0 AD 15 D0 09 40 11
0DC1:8D 15 D0 4C 91 0C AD 08 E6
0DC9:D0 38 E9 12 8D 0C D0 B0 A7
0DD1:E1 A9 00 85 02 F0 DB A2 CD
0DD9:0C A5 27 C9 07 90 02 A2 06
0DE1:0A E6 42 E4 42 B0 59 A9 82
0DE9:00 85 42 AA A9 10 85 B1 A2
```

```
DF1:A9 B9 85 A6 A9 FF A4 FE FF
DF9:C0 64 08 90 16 A9 87 A0 9E
E001:13 A2 07 20 2B 13 A9 FF 2B
E009:85 A6 4D 2B D0 8D 26 D0 C7
E011:A9 03 AA 85 40 86 02 AD 3E
E019:00 DC 05 02 AE 08 D0 AC 11
E021:09 D0 20 23 0C 28 90 0C 5A
E029:E0 00 F0 08 E0 FF F0 04 41
E031:98 4A 90 03 8E 08 D0 C4 69
E039:A6 90 02 A0 B9 8C 09 D0 F9
E041:60 86 39 84 3A 78 F8 18 5C
E049:A5 FB 65 39 85 FB A5 FC DB
E051:65 3A 85 FC A5 FD 69 00 27
E059:85 FD D8 58 A2 01 4C 49 53
E061:0B A9 20 85 B1 A5 A9 A4 E5
E069:AA F0 48 30 01 4A E6 3F 61
E071:38 E9 0A C5 3F B0 3B A9 9E
E079:00 85 3F AD 0A D0 AA 29 CB
E081:03 D0 08 AD FD 87 49 01 D0
E089:8D FD 87 AC 0B D0 A5 AA 39
E091:20 23 0C EC 0A D0 F0 16 62
E099:8E 0A D0 8C 0B D0 C0 41 C0
E0A1:F0 04 C0 64 D0 0C A5 AA 42
E0A9:49 03 85 AA D0 04 A9 00 70
E0B1:85 AA 60 20 1C 14 8A 18 A7
E0B9:69 06 C5 AD B0 1B A9 64 49
E0C1:20 E0 10 98 09 80 85 AA B1
E0C9:A5 49 8D 0B D0 A5 4A 8D AC
E0D1:0A D0 A9 00 85 AD 8D 2C 86
E0D9:D0 60 A5 AB 29 DF 85 AB 65
E0E1:A5 AA 10 F5 29 7F 85 AA D9
E0E9:EE 2C D0 A9 5F A0 13 A2 83
E0F1:0E 20 2B 13 20 1C 14 8A D7
E0F9:4A 85 02 E6 02 A5 A7 29 6A
E101:80 85 B1 20 C8 0B 29 07 C4
E109:C5 02 90 F7 18 65 A7 C5 87
E111:B5 90 02 A5 B5 05 B1 85 73
E119:A7 38 A5 FE 48 90 01 4A 8E
E121:4A 85 02 68 38 E5 02 85 6F
E129:FE A2 0A 20 49 0B 60 A5 8F
E131:AC 30 1F C5 BF D0 F7 A9 CC
E139:7F A0 13 A2 0E 20 2B 13 26
E141:A5 AC 09 80 85 AC A9 00 B8
E149:8D 24 D0 A0 02 A2 00 20 16
E151:42 0E E6 B9 A5 B9 29 1F 12
E159:D0 D4 AD 1F D0 29 80 48 31
E161:AC 0F D0 AE 0E D0 AD 10 BD
E169:D0 29 80 D0 04 E0 F1 90 6F
E171:2B 68 F0 03 88 D0 1E E0 32
E179:57 F0 27 E8 D0 08 AD 10 05
E181:D0 09 80 8D 10 D0 8A AE BA
E189:FF 87 E8 E0 D2 D0 02 A2 35
E191:CF 8E FF 87 AA 8E 0E D0 30
E199:8C 0F D0 60 68 D0 DC C8 EA
E1A1:D0 F3 A2 03 B5 F7 F0 86 9F
E1A9:CA 10 F9 A9 00 8D 15 D0 3C
E1B1:A9 55 A0 16 20 D0 0B A5 6F
E1B9:27 85 02 85 B1 A2 F0 20 7F
E1C1:22 13 A0 07 A2 50 20 42 13
E1C9:0E A5 B1 18 69 05 85 B1 2C
E1D1:20 E6 0F C6 02 D0 E6 A5 CE
E1D9:27 29 07 D0 03 20 97 13 9E
E1E1:E6 27 4C A6 08 8D 0F D4 9A
E1E9:A9 77 A0 13 A2 00 20 2B 80
E1F1:13 A2 F0 4C 22 13 01 02 86
E1F9:04 08 10 DE B4 04 D0 03 66
E201:20 9C 10 BD B4 04 4A 90 11
E209:08 BD F8 87 49 01 9D F8 B6
E211:87 BD B8 04 86 B8 A6 4A 6A
E219:A4 49 20 23 0C 86 4A C0 E3
E221:B9 90 02 A0 B9 84 49 A6 A5
E229:B8 8A 48 0A AA A5 4A 9D 10
E231:00 D0 A5 49 9D 01 D0 68 C9
E239:AA CA 10 0F 60 E6 A8 A5 E9
E241:A8 C5 A9 D0 F7 A9 00 85 55
E249:A8 A2 03 BD F7 0F 85 B1 5B
E251:8A 0A AA 85 A6 BC 00 D0 DF
E259:84 4A BC 01 D0 84 49 4A 6B
E261:AA BD B4 04 D0 95 BD BC 32
E269:04 F0 CE C9 03 F0 11 DE 1B
E271:B0 04 D0 C5 A9 30 A4 B1 6A
E279:C0 03 90 01 0A 9D B0 04 09
E281:A9 00 A4 A6 99 00 D0 99 7D
E289:01 D0 A9 B9 20 E0 10 98 6C
E291:09 01 9D B8 04 9D B4 04 B9
1099:4C 2A 10 AD 10 D0 48 29 C4
10A1:10 85 A6 68 25 B1 F0 02 5A
10A9:A9 10 C5 A6 D0 09 A0 00 B1
10B1:A5 4A CD 08 D0 F0 06 A0 68
10B9:04 90 02 A0 08 84 A6 A0 8A
10C1:01 A5 49 CD 09 D0 90 06 84
10C9:C9 42 90 02 A0 02 98 05 D4
10D1:A6 9D B8 04 20 C8 0B 29 67
10D9:1F 09 10 9D B4 04 60 85 A3
10E1:02 20 C8 0B C9 41 90 F9 43
10E9:C5 02 B0 F5 A8 29 40 D0 1E
10F1:0A 84 4A A9 41 85 49 A0 6F
10F9:0D D0 0C 98 85 49 4A 90 56
1101:12 A9 19 85 4A A0 06 A5 98
1109:B1 49 FF 2D 10 D0 8D 10 18
1111:D0 D0 0E A9 4B 85 4A A5 D6
1119:B1 0D 10 D0 8D 10 D0 A0 55
1121:0A A5 B1 0D 15 D0 8D 15 D4
1129:D0 60 A5 AB A8 29 40 F0 96
1131:47 98 29 BF 85 AB AD 15 89
1139:D0 29 40 F0 3B A2 03 86 16
1141:B8 98 3D F7 0F F0 2C 8A 2C
1149:0A AA AD 0D D0 38 FD 01 06
1151:D0 10 02 49 FF C9 0D B0 A6
1159:1A AD 0C D0 38 FD 00 D0 0D
1161:10 02 49 FF C9 11 B0 0B 34
1169:A6 B8 BD F7 0F 20 C9 11 E1
1171:20 67 0D A6 B8 CA 10 C7 62
1179:A5 AB A8 29 10 F0 0C 98 F5
1181:29 EF 85 AB 29 20 F0 04 4F
1189:20 DB 0E 60 98 29 0F F0 F2
1191:FA AD 15 D0 29 0F F0 F3 A7
1199:20 C8 0B C9 1A B0 F9 C9 4D
11A1:0A 90 F5 18 65 FE 85 FE 5E
11A9:A2 02 20 49 0B A9 0F A2 F5
11B1:04 20 C9 11 AD 09 D0 69 C4
11B9:08 8D 09 D0 A2 03 A9 00 E5
11C1:9D B4 04 CA 10 FA 30 C3 9D
11C9:85 B1 86 AE 84 AF AD 0E 23
11D1:05 10 21 20 C8 0B 8D 5B 89
11D9:13 A0 0F C4 B1 F0 02 A0 D1
11E1:07 98 8D 5E 13 0A 8D 5A 7B
11E9:13 A9 57 A0 13 A2 07 20 46
11F1:2B 13 A6 AE A9 FF 38 E5 D1
11F9:B1 48 2D 15 D0 8D 15 D0 B5
1201:68 25 AB 85 AB A9 00 9D 12
1209:B4 04 E6 AD A5 B1 C9 0F D6
1211:F0 09 A0 00 BD 33 17 AA 97
1219:20 42 0E A6 AE A4 AF 60 D1
1221:48 86 B8 20 E1 0B A6 B8 65
1229:A5 A4 9D 46 05 A5 A5 9D 09
1231:4B 05 BD C7 15 85 26 68 E3
1239:20 FC 09 60 85 02 86 B8 CD
1241:FE 50 05 BD 50 05 29 3F 9D
1249:C9 3F D0 33 FE 50 05 BD 70
1251:46 05 85 A4 BD 4B 05 85 7F
1259:A5 A9 20 A2 01 38 20 D4 E6
1261:09 A0 00 B1 A4 C9 20 D0 AA
1269:18 A6 B8 BD C7 15 85 26 F9
1271:A5 02 20 FC 09 A5 A4 9D 82
1279:46 05 A5 A5 9D 4B 05 18 4D
1281:60 C9 1C F0 22 C9 2B F0 5A
1289:E0 C9 9F F0 DC C9 DF F0 52
1291:1A 48 20 BD 12 68 C9 80 FA
1299:B0 0D E0 04 D0 09 E6 AC DA
12A1:A0 00 A2 20 20 42 0E A6 39
12A9:B8 38 60 A5 02 C9 2B D0 FC
12B1:F6 AD 24 D0 29 0F F0 EF A5
12B9:C6 AC 10 AD 48 A6 B8 E0 78
12C1:04 90 0E A9 67 A0 13 A2 EE
12C9:0E 8E 11 D4 20 2B 13 A6 82
12D1:B8 68 C9 40 90 0D 48 A9 9C
12D9:8F A0 13 A2 07 20 2B 13 9C
12E1:A6 B8 68 29 3F C9 29 D0 6B
12E9:03 DE 46 05 BD 46 05 85 F6
12F1:A4 BD 4B 05 85 A5 AD 23 D2
12F9:D0 85 26 A5 02 A0 DF C9 23
1301:9F F0 02 A0 20 18 A2 02 26
1309:98 20 D4 09 A0 26 A2 E8 7A
1311:C9 DF F0 02 A2 28 8A 91 AE
1319:A4 E8 C8 8A 91 A4 A6 B8 B2
1321:60 A0 00 88 D0 FD CA D0 0D
1329:F8 60 85 A4 84 A5 86 A6 4D
1331:A9 04 18 65 A6 8D 49 13 97
1339:A0 07 A9 D4 C0 03 90 02 29
1341:A9 05 8D 4A 13 B1 A4 99 16
1349:57 04 88 10 ED 60 21 09 6A
1351:10 07 FA 16 20 FF 81 19 1F
1359:39 00 F7 0E 80 00 11 0B 2D
1361:07 1E 11 17 10 FF 41 09 32
1369:07 07 09 17 40 3F 21 00 A8
1371:16 03 2F 17 20 FF 17 18 02
1379:35 09 34 17 10 FF 41 09 80
1381:07 0E 02 17 40 3F 11 00 81
1389:A6 00 09 D0 10 FE 81 09 B9
1391:19 16 11 17 80 FF A9 0B BF
1399:8D 21 D0 A9 0C 8D 20 D0 2B
13A1:A9 87 85 A5 A9 20 85 A4 07
13A9:A9 80 8D 15 D0 49 FF 8D 01
13B1:10 D0 A9 12 85 A6 85 AF EB
13B9:A9 00 85 26 85 B5 A6 A6 BE
13C1:A9 1C 18 20 D4 09 A2 04 DC
13C9:A9 20 18 20 D4 09 A6 AF 99
13D1:A9 1C 18 20 D4 09 E6 A6 18
13D9:CA 86 AF E0 0D D0 DF A2 19
13E1:14 A0 12 18 20 F0 FF A9 6C
13E9:70 A0 16 20 D0 0B A2 19 46
13F1:8E 0E D0 A0 71 88 D0 FD 54
13F9:20 53 0F AC 0F D0 C0 FE ED
1401:D0 F1 A0 59 A2 50 20 42 90
1409:0E A0 40 A2 50 8E 33 17 CC
1411:20 42 0E A9 00 20 E6 0F 93
1419:4C 22 13 A6 27 E0 08 90 1A
1421:02 A2 08 60 AD 1E D0 C0 4F
1429:78 05 F0 05 85 AB 8D 78 AB
1431:05 A5 B5 F0 2B A9 98 18 54
1439:6D 00 04 85 3D A9 DB 85 BE
1441:3E A5 BF 0A A8 88 20 C8 FA
1449:0B 29 03 AA BD F6 16 91 D3
1451:3D E0 02 D0 08 AD FC 87 16
1459:49 01 8D FC 87 88 10 E6 4D
1461:A9 0E AA BD 07 05 30 1E DD
1469:A8 BD 08 05 85 3D BD 09 4C
1471:05 85 3E B1 3D 3D 0B 05 5A
1479:9D 01 D4 DE 07 05 10 06 AB
1481:BD 0A 05 9D 04 D4 8A 38 46
1489:E9 07 10 D6 A5 27 C9 09 3E
1491:90 03 EE 27 D0 4C 31 EA 18
1499:30 E0 00 78 30 00 F8 F8 06
14A1:00 BF F8 00 30 70 00 24 40
14A9:20 00 21 20 00 70 60 00 8A
14B1:FF E8 00 F8 F8 00 60 F0 1D
14B9:00 38 60 00 00 00 00 00 FB
14C1:E7 EF 1F 80 00 07 C0 00 63
14C9:07 80 00 48 48 00 F0 38 76
14D1:00 F1 38 00 E4 78 00 E0 67
14D9:78 00 90 90 00 0F 00 00 95
14E1:1F 00 00 0F C0 00 00 00 90
14E9:00 00 E7 EF 80 04 00 70 92
14F1:38 00 60 18 00 5F E8 00 13
14F9:16 20 00 14 A0 00 11 A0 3E
1501:00 5F E8 00 60 18 00 70 F3
1509:38 00 80 04 EF EF 90 24 24
1511:00 60 18 00 60 18 00 9F 59
1519:E4 00 16 20 00 14 A0 00 0C
1521:11 A0 00 9F E4 00 60 18 F5
1529:00 60 18 00 90 24 EF EF 53
1531:00 00 00 00 28 00 00 BE 5B
1539:00 0A C3 A0 6F FF F9 0B E2
1541:33 20 02 AA 80 00 55 00 A6
1549:EF EF E7 00 28 00 00 28 CD
1551:00 00 BE 00 0A C3 A0 6F 63
1559:FF F9 08 CC E0 02 AA 80 B4
1561:00 55 00 EF EF E7 88 88 98
1569:00 55 54 00 22 22 EF EF DC
1571:EF E7 18 00 00 10 00 00 D0
1579:74 00 00 52 00 00 18 00 33
1581:00 2C 00 00 64 00 00 00 D9
1589:00 00 EF EF E7 18 00 00 50
1591:10 00 00 74 00 00 12 00 2F
1599:00 B0 00 00 68 00 00 0C 3F
15A1:00 00 00 00 00 EF EF E7 53
15A9:18 00 00 10 00 00 38 00 51
15B1:00 58 00 00 34 00 00 30 C3
15B9:00 00 38 00 00 00 00 00 EA
15C1:EF EF E7 ED 01 00 01 07 CC
15C9:03 06 0B 00 02 00 C8 C8 C2
15D1:C8 C8 CC CA CE CF 8E 08 B3
15D9:90 92 53 50 59 20 44 45 79
15E1:46 45 4E 53 45 11 11 9D AD
```

```
15E9:9D 9D 9D 9D 9D 9D DD 11 08
15F1:9D 9D C0 DB C0 C9 11 9D 15
15F9:9D 9D 9D BE AD C0 BD 0D F2
1601:11 11 11 11 11 20 20 20 96
1609:20 20 28 46 31 29 20 3D 62
1611:20 53 54 41 52 54 20 20 05
1619:20 20 20 43 54 52 4C 2D 47
1621:43 20 3D 20 53 54 4F 50 7B
1629:00 90 93 12 53 43 4F 52 A5
1631:45 3A 30 30 30 30 30 30 6A
1639:20 44 41 4D 41 47 45 3A 6F
1641:30 30 30 25 20 50 49 54 13
1649:23 30 31 20 50 49 45 43 B0
1651:45 53 3A 00 13 11 92 05 43
1659:1D 1D 1D 1D 1D 1D 1D C2 2B
1661:CF CE D5 D3 00 13 12 90 22
1669:1D 1D 1D 1D 1D 1D 00 90 CE
1671:92 29 11 29 11 29 11 29 5E
1679:11 29 91 91 91 91 9D 9D 6F
1681:97 A9 11 A9 11 A9 11 A9 9B
1689:11 A9 13 11 11 11 11 11 1C
1691:1D 1D 9F 43 4F 4E 47 52 50
1699:41 54 55 4C 41 54 49 4F 28
16A1:4E 53 2C 20 59 4F 55 27 2B
16A9:56 45 20 53 41 56 45 44 BD
16B1:20 54 48 45 20 53 50 59 A8
16B9:0D 11 11 1D 1D 1D 9A 50 87
16C1:52 45 50 41 52 45 20 54 C2
16C9:4F 20 44 45 46 45 4E 44 AA
16D1:20 41 4E 4F 54 48 45 52 BD
16D9:00 92 28 29 00 00 04 06 50
16E1:0E 07 0D 06 02 05 0E 0E 27
16E9:04 04 05 0C 0A 06 02 01 E7
16F1:0D 0C 0A 08 04 02 07 08 A7
16F9:09 0F 18 23 28 29 3E 50 56
1701:69 2C 26 20 1D 19 16 14 43
1709:17 1B 1E 21 37 20 12 02 BF
1711:31 2E 2D 2B 29 27 25 21 0D
1719:1E 1B 17 14 11 0D 09 04 14
1721:01 00 00 00 00 00 00 09 D8
1729:0C 0E 11 15 18 1B A0 A6 69
1731:AD B4 05 05 10 25 96 87 1E
1739:6E 50 32 0A 0D 00 00 00 02
```

BEFORE TYPING . . .

Before typing in programs, please refer to "How to Type In COMPUTE!'s GAZETTE Programs," elsewhere in this issue.

Smart VAL

Article on page 74.

```
XQ 100 REM COPYRIGHT 1988 COMP
       UTE! PUBLICATIONS, INC.
       - ALL RIGHTS RESERVED
XM 110 PRINT CHR$(147)"{BLK}
       {3 SPACES}COPYRIGHT 198
       8 COMPUTE! PUB., INC."
KK 120 PRINT TAB(11)"ALL RIGHT
       S RESERVED"
QK 130 GOSUB 1000
RE 140 PRINT CHR$(147)"SMART V
       AL() INSTALLED.":END
FK 1000 REM READ AND STORE MAC
        HINE CODE
XB 1010 SA=49152:REM STARTING
        {SPACE}ADDRESS
CG 1020 H1=INT((SA+13)/256):L1
        =(SA+13)-H1*256
JS 1030 H2=INT((SA+150)/256):L
        2=(SA+150)-H2*256:CS=0
KB 1040 FOR AD=SA TO SA+206:RE
        AD ML:CS=CS+ML:POKE AD
        ,ML:NEXT
QK 1050 IF CS<>23175 THEN PRIN
        T CHR$(147)"*** ERROR
        {SPACE}IN DATA STATEME
        NTS ***":END
ME 1060 POKE SA+5,L1:POKE SA+9
        ,H1:POKE SA+133,L2:POK
        E SA+138,H2:REM RELOCA
        TE ML
SF 1070 SYS 49152
XF 1080 RETURN
KJ 1090 DATA 169,076,133,124,1
        69,013,133,125
EP 1100 DATA 169,192,133,126,0
        96,141,255,003
HC 1110 DATA 104,141,252,003,1
        04,141,253,003
MQ 1120 DATA 072,173,252,003,0
        72,201,217,208
SJ 1130 DATA 007,173,253,003,2
        01,183,240,011
PX 1140 DATA 173,255,003,201,0
        58,176,003,076
HK 1150 DATA 128,000,096,104,1
        69,220,072,186
SR 1160 DATA 142,254,003,165,1
        13,141,248,003
MX 1170 DATA 165,114,141,249,0
        03,162,079,189
BA 1180 DATA 000,002,157,167,0
        03,202,016,247
CE 1190 DATA 056,165,036,229,1
        22,168,162,023
CP 1200 DATA 201,081,176,073,1
        69,000,141,013
XQ 1210 DATA 003,153,000,002,1
        36,177,122,153
GA 1220 DATA 000,002,136,016,2
        48,169,000,133
RM 1230 DATA 122,169,002,133,1
        23,032,121,165
SC 1240 DATA 173,000,003,141,2
        50,003,173,001
XQ 1250 DATA 003,141,251,003,1
        69,150,141,000
CB 1260 DATA 003,169,192,141,0
        01,003,032,115
JB 1270 DATA 000,032,138,173,1
        62,000,173,250
MP 1280 DATA 003,141,000,003,1
        73,251,003,141
BA 1290 DATA 001,003,173,013,0
        03,138,141,013
AQ 1300 DATA 003,240,006,169,0
        00,133,097,133
XP 1310 DATA 102,173,248,003,1
        33,113,173,249
RK 1320 DATA 003,133,114,162,0
        79,189,167,003
KD 1330 DATA 157,000,002,202,0
        16,247,169,000
SJ 1340 DATA 133,013,174,254,0
        03,154,096,000
```

Four For The 64

Article on page 78.

Program 1: Calculated GOTO Demo

```
FH 5 REM COPYRIGHT 1988
     {2 SPACES}COMPUTE! PUBLIC
     ATIONS, INC.{2 SPACES}ALL
     RIGHTS RESERVED.
GC 10 PRINT"{CLR}{5 DOWN}
      {13 RIGHT}COPYRIGHT 1988
      "
DS 12 PRINT"{7 RIGHT}COMPUTE!
      {SPACE}PUBLICATIONS, INC
      ."
SE 14 PRINT"{10 RIGHT}ALL RIGH
      TS RESERVED."
KK 16 FOR I=1 TO 2000:NEXT:PRI
      NT"{CLR}"
RA 20 FOR GL=50 TO 90 STEP 10
KH 30 POKE 785,188:POKE 786,1
      8:SYS 47083(GL),USR(0)
DB 40 NEXT GL:LIST
FX 50 PRINT "LINE 50":GOTO 40
QJ 60 PRINT "LINE 60":GOTO 40
PM 70 PRINT "LINE 70":GOTO 40
FE 80 PRINT "LINE 80":GOTO 40
HG 90 PRINT "FINALLY, LINE 90"
      :GOTO 40
```

Program 2: Selective RESTORE Demo

```
FH 5 REM COPYRIGHT 1988
     {2 SPACES}COMPUTE! PUBLIC
     ATIONS, INC.{2 SPACES}ALL
     RIGHTS RESERVED.
AF 10 PRINT"{CLR}{5 DOWN}
      {13 RIGHT}COPYRIGHT 1988
HP 12 PRINT"{7 RIGHT}COMPUTE!
      {SPACE}PUBLICATIONS, INC
      .
SE 14 PRINT"{10 RIGHT}ALL RIGH
      TS RESERVED."
BD 15 FOR X=1 TO 2000:NEXT:PRI
      NT"{CLR}"
SX 20 PRINT CHR$(147):PRINT "R
      EADING DATA IN ASCENDING
       ORDER...";
KD 30 FOR RL=1700 TO 140 STEP 1
      0:GOSUB 1000:READ D$:PRI
      NT D$;:NEXT RL
HM 40 PRINT:PRINT:PRINT "READI
      NG DATA IN DECENDING ORD
      ER...";
JR 50 FOR RL=140 TO 100 STEP -
      10:GOSUB 1000:READ D$:PR
      INT D$;:NEXT RL
PF 60 PRINT:PRINT:PRINT "READI
      NG DATA IN RANDOM ORDER.
      ..";
MX 70 FOR I=1 TO 5:RL=INT(RND(
      1)*40)+100:GOSUB 1000:RE
      AD D$:PRINT D$;:NEXT I
AX 80 PRINT:END
JB 100 DATA FIRST
AR 110 DATA SECOND
XH 120 DATA THIRD
XD 130 DATA FOURTH
EF 140 DATA FIFTH
FA 1000 POKE 785,232:POKE 786,
        7:POKE 209,232:POKE 21
        0,7:POKE 211,0:POKE 21
        3,39
HR 1010 PRINT " S{RVS}&${OFF}
        §*§{RVS}HD{OFF}A{RVS}$
        {OFF}{SHIFT-SPACE}
        {RVS}D{OFF}B
        {SHIFT-SPACE}":SYS 470
        83(RL),USR(0):RETURN
```

Program 3: BSAVE Demo

```
EJ 5 REM COPYRIGHT 1988
     {2 SPACES}COMPUTE! PUBLIC
     ATIONS, INC.
GC 10 PRINT"{CLR}{5 DOWN}
      {13 RIGHT}COPYRIGHT 1988
      "
DS 12 PRINT"{7 RIGHT}COMPUTE!
      {SPACE}PUBLICATIONS, INC
      ."
SE 14 PRINT"{10 RIGHT}ALL RIGH
      TS RESERVED."
CD 16 FOR X=1 TO 2000:NEXT:PRI
      NT"{CLR}"
QX 20 POKE 53281,14:PRINT CHR$
      (147):POKE 53281,6:SYS 5
      7812 "SCREEN",8,1:POKE 7
      80,0
HS 30 SYS 65493:OPEN 15,8,15:I
      NPUT#15,E:CLOSE 15:SYS 6
      5487
SD 40 OPEN15,8,15,"S0:SCREEN":
```

```
      CLOSE15:F$="SCREEN":D=8:
      SA=1024:EA=2024
GS 1000 SYS 57812 F$,D:POKE 17
      3,SA/256:POKE 172,SA-P
      EEK(173)*256:POKE 780,
      172
RG 1010 POKE 782,EA/256:POKE 7
      81,EA-PEEK(782)*256:SY
      S 65496
GR 1020 PRINT CHR$(147)
```

Program 4: Disk Directory Demo

```
FH 5 REM COPYRIGHT 1988
     {2 SPACES}COMPUTE! PUBLIC
     ATIONS, INC.{2 SPACES}ALL
      RIGHTS RESERVED.
GC 10 PRINT"{CLR}{5 DOWN}
     {13 RIGHT}COPYRIGHT 1988
     "
DS 12 PRINT"{7 RIGHT}COMPUTE!
     {SPACE}PUBLICATIONS, INC
     ."
SE 14 PRINT"{10 RIGHT}ALL RIGH
     TS RESERVED."
CD 16 FOR X=1 TO 2000:NEXT:PRI
     NT"{CLR}"
JP 20 PRINT "INSERT DISK AND P
     RESS RETURN":WAIT 197,1,
     1:WAIT 197,1
CF 30 D=8:GOSUB 1000:PRINT:PRI
     NT:PRINT "ANOTHER DISK (
     Y/N)? ";:POKE 198,0
CS 40 GET K$:ON -(K$<>"Y"ANDK$
     <>"N") GOTO 40:PRINT K$:
     ON -(K$="Y") GOTO 20:END
RP 1000 SYS 57812"$",D:POKE 43
      ,1:POKE 44,192:POKE 76
      8,174:POKE 769,167:SYS
      47003,1
EX 1010 POKE 782,192:SYS 65493
      :SYS 42291:LIST:POKE 4
      4,8:POKE 768,139:POKE
      {SPACE}769,227
SS 1020 RETURN
```

Key Clicker

Article on page 63.

Program 1: Key Clicker—64 Version

```
HE 10 REM COPYRIGHT 1988 COMPU
      TE! PUBLICATIONS, INC. -
       ALL RIGHTS RESERVED
PE 20 A=679:V=655:T=64:Z=6238:
      C=0:IFPEEK(65530)<>5THEN
      40
GQ 30 3{B}15:A=2816:V=828:T=68
      :Z=6473:C=2
DK 40 PRINT"{CLR}{3 SPACES}COP
      YRIGHT 1988 COMPUTE! PUB
      ., INC."
JB 50 PRINTTAB(11)"ALL RIGHTS
      {SPACE}RESERVED"
FH 60 FORI=1TOT:READB:X=X+B:NE
      XT:IFX<>ZTHENPRINT"
      {DOWN}DATA STATEMENT ERR
      OR.":STOP
RP 70 RESTORE:FORI=54272TO5429
      6:POKEI,0:NEXT:REM CLEAR
       SID
PC 80 FORI=54272TO54296:READK:
      POKEI,K:NEXT:REM SETUP S
      ID CHIP
EC 90 FORI=0TOT-26:READK:POKEA
      +I,K:NEXT
SX 100 REM CHOOSE SOUND AND PA
      TCH VOICE SELECTION INT
      O ML ROUTINE
KM 110 PRINT"{CLR}SELECT SOUND
      : ":PRINT"{2 SPACES}COM
      PUTER":PRINT"{2 SPACES}
      TYPEWRITER"
BK 120 PRINT"{2 SPACES}DRAMATI
      C":INPUT"SELECTION";S$:
      S$=LEFT$(S$,1)
RF 130 IFS$<>"C"ANDS$<>"T"ANDS
      $<>"D"THEN110
GB 140 IFS$="C"THENS1=4:S2=4:B
      =64
KG 150 IFS$="T"THENS1=11:S2=11
      :B=128
XE 160 IFS$="D"THENS1=11:S2=18
      :B=128
KD 170 A=A+C:POKEA+20,S1:POKEA
      +25,S1:POKEA+31,S2:POKE
      A+36,S2
XG 180 POKEA+18,B:POKEA+29,B:P
      OKEA+23,B+1:POKEA+34,B+
      1:A=A-C
GP 190 REM SPLICE INTO KEYBOAR
      D VECTOR
PB 200 AH=INT(A/256):AL=A-256*
      AH:POKEV,AL:POKEV+1,AH
SF 210 REM SID REGISTER CONTEN
      TS
MH 220 DATA 0,28,0,4,64,19,0
MQ 230 DATA 0,255,0,0,128,19,0
RX 240 DATA 0,32,0,12,128,11,0
DC 250 DATA 0,50,245,47
GQ 300 REM 64 MACHINE LANGUAGE
       ROUTINE
CJ 310 DATA 165,198,72,32,72,2
      35,104,197
AF 320 DATA 198,240,16,165,197
      ,201,1,240
KM 330 DATA 11,169,128,141,11,
      212,169,129
JA 340 DATA 141,11,212,96,169,
      128,141,18
DG 350 DATA 212,169,129,141,18
      ,212,96
```

Program 2: Key Clicker—128 Line Substitutions

```
MS 300 REM 128 MACHINE LANGUAG
      E ROUTINE
FX 310 DATA 201,13,8,170,165,2
      08,72,138
BS 320 DATA 32,173,198,104,197
      ,208,240,25
MB 330 DATA 40,240,11,169,128,
      141,11,212
AM 340 DATA 169,129,141,11,212
      ,96,169,128
ED 350 DATA 141,18,212,169,129
      ,141,18,212
MA 360 DATA 96,40,96
```

3-D Speedway

See program listing on page 20 before typing in.

```
C000:20 8B CC A9 7F 8D 0D DC D1
C008:A9 24 8D 14 03 A9 C0 8D 28
C010:15 03 A9 1B 8D 11 D0 A9 BF
C018:01 8D 1A D0 AD 11 D0 8D AE
C020:FA CC 60 60 A9 01 8D 19 E9
C028:D0 A2 93 A0 2E AD 12 D0 54
C030:C9 64 90 04 A2 01 A0 5D B9
C038:8A 48 A2 03 CA D0 FD AD D8
C040:FA CC 4C 48 C0 AD FD CC 06
C048:8D 16 D0 68 8D 12 D0 AD BA
C050:0D DC 4A 90 03 4C 31 EA 78
C058:4C BC FE A9 06 8D 21 D0 23
C060:A9 0F 8D 20 D0 A0 00 8C C3
C068:15 D0 A9 54 A0 CA 20 1E B1
C070:AB A9 00 85 C6 A5 C5 C9 AC
C078:40 F0 FA D8 A9 93 20 D2 F1
C080:FF A0 00 A9 08 99 30 DA A6
C088:C8 C0 28 D0 F6 A0 00 A9 94
C090:A0 99 58 06 A9 05 99 58 21
C098:DA C8 C0 C8 D0 F1 A0 00 ED
C0A0:A9 A0 99 20 07 A9 05 99 D6
C0A8:20 DB C8 C0 C8 D0 F1 A9 6D
C0B0:FF 8D 15 D0 A9 FC 8D 1C BD
C0B8:D0 8D 1D D0 A9 07 8D 27 62
C0C0:D0 8D 28 D0 A9 D5 8D 05 E4
C0C8:D0 A9 09 8D 26 D0 A9 00 DE
C0D0:8D 25 D0 8D 1E D0 8D 00 A4
C0D8:D4 A8 99 63 CC C8 C0 27 8A
C0E0:D0 F8 8D 06 D0 8D 07 D0 B6
C0E8:8D 08 D0 8D 09 D0 8D FC C9
C0F0:CC A9 04 8D 7A CC 8D 76 35
C0F8:CC A9 08 8D 75 CC A9 1A 71
C100:8D 6C CC A9 02 8D 71 CC 8F
C108:A9 FF 8D FB CC A9 32 8D D0
C110:7F CC A9 64 8D 7B CC A9 9F
C118:0F 8D 18 D4 A9 08 8D 08 67
C120:D4 A9 0A 8D 0C D4 8D 05 66
C128:D4 A9 CC 8D 0D D4 A9 03 05
C130:8D 01 D4 A9 C0 8D 06 D4 0D
C138:A9 21 8D 04 D4 A9 A0 8D E6
C140:6B CC EE 68 CC AD 7E CC F7
C148:65 A2 65 A2 6D 12 D0 6D C0
C150:12 D0 6D 12 D0 8D 7E CC 66
C158:A0 04 AD 71 CC 4A 18 69 23
C160:28 69 01 C9 FF D0 FA 88 D0
C168:D0 F0 18 AD 88 CC 69 01 B9
C170:8D 88 CC AD 89 CC 69 00 A3
C178:8D 89 CC AD 8A CC 69 00 F3
C180:8D 8A CC 18 AD 68 CC 4A 7B
C188:4A 4A 69 01 6D 69 CC 8D 39
C190:69 CC AD 71 CC 69 02 8D 66
C198:71 CC 8D 00 D4 18 AD 71 8D
C1A0:CC C9 08 B0 05 A9 08 8D 75
C1A8:71 CC 18 AD 71 CC C9 F8 41
C1B0:90 05 A9 F8 8D 71 CC AC FA
C1B8:69 CC B9 89 C9 8D 6A CC 1A
C1C0:18 AD 69 CC 69 A7 AA AC A1
C1C8:69 CC B9 44 C9 8D 66 CC CD
C1D0:0A 8D 65 CC AC 6C CC A9 90
C1D8:00 8D 63 CC 8D 64 CC 18 A8
C1E0:AD 63 CC 6D 66 CC 8D 63 69
C1E8:CC AD 64 CC 69 00 8D 64 62
C1F0:CC 88 D0 EB A0 04 18 4E 69
C1F8:64 CC 6E 63 CC 88 D0 F6 07
C200:18 AD 63 CC 69 B4 ED 65 95
C208:CC 8D 74 CC A9 FC 8D 15 24
C210:D0 18 AD 74 CC ED 69 CC BE
C218:ED 69 CC A8 18 AD 74 CC 40
C220:6D 69 CC 6D 69 CC 8E 01 C3
C228:D0 8E 03 D0 8D 00 D0 8C C1
C230:02 D0 AD 10 D0 29 FE 69 34
C238:00 8D 10 D0 18 AD 6A CC 49
C240:69 D0 8D F8 07 8D F9 07 59
C248:A9 FF 8D 15 D0 AD 7C CC A8
C250:18 69 01 8D 7C CC C9 14 F3
C258:D0 27 A9 00 8D 7C CC 20 5D
C260:DA C5 AD 73 CC 18 69 01 4C
C268:8D 73 CC C9 10 D0 12 A9 59
C270:0F 8D 73 CC 20 70 C4 AD 16
C278:72 CC C9 00 F0 03 20 57 CE
C280:C6 A9 00 85 C6 AD 1E D0 26
C288:29 04 C9 04 D0 03 20 B5 A5
C290:C7 A9 78 8D 77 CC A9 C8 57
C298:8D 78 CC AD 00 DC 8D 79 7F
C2A0:CC AD 79 CC 29 10 C9 10 21
C2A8:D0 09 AD 71 CC 38 E9 03 C3
C2B0:8D 71 CC AD 79 CC 29 04 23
C2B8:C9 04 F0 24 AD 6B CC 38 71
C2C0:E9 01 8D 6B CC AD 78 CC BE
C2C8:38 E9 1E 8D 78 CC AD 77 4B
C2D0:CC 38 E9 1E 8D 77 CC AD 7B
C2D8:71 CC 38 E9 03 8D 71 CC ED
C2E0:AD 79 CC 29 08 C9 08 F0 30
C2E8:24 AD 6B CC 18 69 01 8D 1C
C2F0:6B CC AD 78 CC 18 69 1E 54
C2F8:8D 78 CC AD 77 CC 18 69 60
C300:1E 8D 77 CC AD 71 CC 38 BA
C308:E9 03 8D 71 CC AD 6B CC CE
C310:C9 F0 90 05 A9 F0 8D 6B B2
```

```
C318:CC AD 6B CC C9 51 B0 05 A5
C320:A9 51 8D 6B CC AD 6B CC F9
C328:8D 04 D0 A9 02 8D 7D CC 3A
C330:AD 6B CC CD 77 CC 90 05 F4
C338:A9 01 8D 7D CC AD 6B CC 1F
C340:CD 78 CC 90 05 A9 00 8D CB
C348:7D CC 18 AD 7D CC 69 D7 69
C350:8D FA 07 AD 69 CC C9 41 6C
C358:B0 03 4C 42 C1 A9 00 8D E8
C360:68 CC 8D 69 CC 8D 6A CC D5
C368:A9 07 8D 27 D0 8D 28 D0 88
C370:8D 20 D0 A9 03 8D 01 D4 A0
C378:AD 80 CC 18 69 01 8D 80 FC
C380:CC AD 81 CC 69 00 8D 81 BE
C388:CC 18 AD 81 CC C9 00 D0 A8
C390:10 18 AD 80 CC C9 FA D0 38
C398:08 A9 00 8D 80 CC 8D 81 3B
C3A0:CC AD 81 CC C9 00 D0 41 28
C3A8:AD 80 CC C9 03 B0 3A AD 5A
C3B0:FC CC D0 35 A9 00 8D 20 DF
C3B8:D0 EE FB CC 20 FE CC A9 F0
C3C0:08 8D FC CC A9 01 8D 27 AF
C3C8:D0 8D 28 D0 AD 80 CC 0A 41
C3D0:0A 0A 18 69 1E 8D 01 D4 77
C3D8:AD 7F CC 38 E9 03 8D 7F 2A
C3E0:CC A9 00 85 A0 85 A1 85 75
C3E8:A2 A5 A2 8D 63 CC A5 A1 93
C3F0:8D 64 CC A0 06 4E 64 CC FA
C3F8:6E 63 CC 88 D0 F7 AD 63 D7
C400:CC CD 7F CC D0 03 4C 2B 76
C408:C8 A9 3E A0 CB 20 1E AB F8
C410:AD FC CC F0 03 CE FC CC 72
C418:AD 7F CC 38 ED 63 CC 8D 99
C420:FA CC 8A 48 AE FA CC CA F5
C428:A9 00 20 CD BD A9 20 20 5C
C430:D2 FF 68 AA AD 7E CC 29 05
C438:02 8D 65 CC AD 7E CC 29 C9
C440:01 18 6D 65 CC C9 03 D0 B8
C448:02 A9 01 18 6D 6C CC 38 CD
C450:E9 01 8D 6C CC AD 6C CC 4A
C458:C9 0E D0 05 A9 0F 8D 6C C5
C460:CC AD 6C CC C9 29 D0 05 AF
C468:A9 28 8D 6C CC 4C 42 C1 27
C470:EE 6D CC AD 6D CC 4A 4A BE
C478:18 6D 6E CC 8D 6E CC AD 71
C480:6E CC C9 16 90 05 A9 01 FB
C488:8D 72 CC AC 6E CC B9 D4 C8
C490:C9 8D 6A CC AD 7E CC 29 A6
C498:82 C9 80 F0 03 4C D2 C4 A8
C4A0:AD 7E CC 6A 6A 6A 8D 66 5F
C4A8:CC 29 02 8D 65 CC AD 66 1C
C4B0:CC 29 01 6D 65 CC C9 03 D6
C4B8:D0 02 A9 01 18 6D 75 CC 9E
C4C0:38 E9 01 8D 75 CC AD 75 89
C4C8:CC C9 01 D0 05 A9 02 8D B8
C4D0:75 CC AD 75 CC C9 0F 90 91
C4D8:05 A9 0E 8D 75 CC 18 AD A6
C4E0:6E CC 69 9F AA AC 6E CC AD
C4E8:B9 44 C9 8D 66 CC 0A 8D 7A
C4F0:65 CC AC 6C CC A9 00 8D 57
C4F8:63 CC 8D 64 CC 18 AD 63 E4
C500:CC 6D 66 CC 8D 63 CC AD 28
C508:64 CC 69 00 8D 64 CC 88 46
C510:D0 EB A0 04 18 4E 64 CC E2
C518:6E 63 CC 88 D0 F6 AD 6E 02
C520:CC 4A 8D 67 CC 18 AD 63 52
C528:CC 69 9F 38 ED 67 CC 38 CA
C530:ED 65 CC 8D 66 CC AD 75 B5
C538:CC 38 E9 01 A8 A9 00 8D FE
C540:63 CC 8D 64 CC C0 00 F0 03
C548:15 18 AD 63 CC 6D 6E CC 16
C550:8D 63 CC AD 64 CC 69 00 19
C558:8D 64 CC 88 D0 EB A0 03 60
C560:18 4E 64 CC 6E 63 CC 88 08
C568:D0 F6 AD 6E CC 4A 8D 79 DA
C570:CC 18 AD 63 CC 6D 66 CC 0A
C578:8D 63 CC A9 00 69 00 8D 0B
C580:64 CC 38 AD 63 CC ED 79 F6
C588:CC 8D 63 CC AD 64 CC E9 99
C590:00 8D 64 CC AD 64 CC 0A 7B
C598:0A 0A 8D 64 CC A0 F7 8C 09
C5A0:15 D0 8E 07 D0 AD 63 CC FD
C5A8:8D 06 D0 AD 10 D0 29 F7 7F
C5B0:18 6D 64 CC 8D 10 D0 A9 F4
C5B8:DF 38 ED 6A CC 8D FB 07 42
C5C0:A9 FF 8D 15 D0 AD 6E CC 0B
C5C8:C9 42 90 0D A9 00 8D 6D 82
C5D0:CC 8D 6E CC A9 09 8D 75 C2
C5D8:CC 60 AC 6C CC B9 1A CA 8B
C5E0:8D 65 CC AD 7A CC 18 6D A5
C5E8:65 CC 38 E9 02 8D 7A CC 08
C5F0:18 AD 7A CC C9 C8 90 0C AE
C5F8:AD 7A CC 18 69 08 8D 7A 16
C600:CC EE 7B CC AD 7A CC C9 A6
C608:08 90 0C AD 7A CC 38 E9 7B
C610:08 8D 7A CC CE 7B CC AD CC
C618:7B CC C9 00 D0 05 A9 C8 86
C620:8D 7B CC AD 7B CC C9 C9 34
C628:D0 05 A9 01 8D 7B CC A9 42
C630:C0 18 6D 7A CC 29 C7 8D A1
C638:FD CC A2 00 E8 8A 18 6D 5B
C640:7B CC A8 B9 73 CB 38 E9 94
C648:40 C9 E0 D0 02 A9 20 9D 26
C650:2F 06 E0 28 D0 E6 60 EE 67
C658:6F CC AD 6F CC 4A 4A 18 B9
C660:6D 70 CC 8D 70 CC AC 70 B3
C668:CC B9 D4 C9 8D 6A CC AD 5F
C670:7E CC 29 C0 C9 40 F0 03 D5
C678:4C AC C6 AD 7E CC 6A 6A 71
C680:8D 66 CC 29 02 8D 65 CC 78
C688:AD 66 CC 29 01 6D 65 CC 08
C690:C9 03 D0 02 A9 01 18 6D EC
C698:76 CC 38 E9 01 8D 76 CC 32
C6A0:AD 76 CC C9 00 D0 05 A9 CF
C6A8:01 8D 76 CC AD 76 CC C9 60
C6B0:0E 90 05 A9 0D 8D 76 CC FC
C6B8:18 AD 70 CC 69 9F AA AC 64
C6C0:70 CC B9 44 C9 8D 66 CC 53
C6C8:0A 8D 65 CC AC 6C CC A9 92
C6D0:00 8D 63 CC 8D 64 CC 18 AA
C6D8:AD 63 CC 6D 66 CC 8D 63 6B
C6E0:CC AD 64 CC 69 00 8D 64 64
C6E8:CC 88 D0 EB A0 04 18 4E 6B
C6F0:64 CC 6E 63 CC 88 D0 F6 09
C6F8:AD 70 CC 4A 8D 67 CC 18 73
C700:AD 63 CC 69 9F 38 ED 67 90
C708:CC 38 ED 65 CC 8D 66 CC 56
C710:AD 76 CC 38 E9 01 A8 A9 7F
C718:00 8D 63 CC 8D 64 CC C0 9C
C720:00 F0 15 18 AD 63 CC 6D 12
C728:70 CC 8D 63 CC AD 64 CC BD
C730:69 00 8D 64 CC 88 D0 EB 82
C738:A0 03 18 4E 64 CC 6E 63 57
C740:CC 88 D0 F6 AD 70 CC 4A F4
C748:8D 79 CC 18 AD 63 CC 6D 1A
C750:66 CC 8D 63 CC A9 00 69 A4
C758:00 8D 64 CC 38 AD 63 CC B0
C760:ED 79 CC 8D 63 CC AD 64 C5
C768:CC E9 00 8D 64 CC AD 64 C7
C770:CC 0A 0A 0A 0A 8D 64 CC E6
C778:A0 EF 8C 15 D0 8E 09 D0 DA
C780:AD 63 CC 8D 08 D0 AD 10 21
C788:D0 29 EF 18 6D 64 CC 8D 6E
C790:10 D0 A9 DF 38 ED 6A CC AA
C798:8D FC 07 A9 FF 8D 15 D0 DA
C7A0:AD 70 CC C9 42 90 0D A9 71
C7A8:00 8D 6F CC 8D 70 CC A9 C7
C7B0:05 8D 76 CC 60 A9 10 8D 19
C7B8:04 D4 A9 81 8D 0B D4 AD BC
C7C0:FA 07 8D 65 CC A9 02 8D 36
C7C8:29 D0 A0 91 A9 00 8D 66 1D
C7D0:CC 88 18 A5 A2 29 04 4A 52
C7D8:4A 69 D5 8D FA 07 A2 FF B4
C7E0:8D FA 07 8D FA 07 8D FA B9
C7E8:07 CA D0 F4 C0 06 D0 E1 B9
C7F0:AD 65 CC 8D FA 07 A9 03 6D
C7F8:8D 29 D0 A9 00 8D 06 D0 61
C800:8D 08 D0 8D 72 CC 8D 73 A2
C808:CC 8D 07 D0 8D 09 D0 8D 11
C810:6D CC 8D 6E CC 8D 6F CC 6C
C818:8D 70 CC A9 80 8D 0B D4 E5
C820:A9 21 8D 04 D4 A9 02 8D 9F
C828:71 CC 60 AD 71 CC 8D 63 C9
C830:CC A9 03 8D 64 CC A0 78 DB
C838:CE 63 CC D0 03 CE 64 CC 99
C840:AD 63 CC 8D 00 D4 AD 64 07
C848:CC 8D 01 D4 88 C0 00 D0 29
C850:EF AD 64 CC C9 00 D0 DE 6D
C858:AD 63 CC C9 01 D0 D7 A9 74
C860:02 8D 01 D4 38 AD 88 CC 1A
C868:E9 01 8D 88 CC AD 89 CC 66
C870:E9 00 8D 89 CC AD 8A CC 40
C878:E9 00 8D 8A CC A9 20 8D 34
C880:04 D4 18 AD 87 CC 69 01 6A
C888:8D 87 CC C9 0A D0 5F A9 F4
C890:00 8D 87 CC 18 AD 86 CC 94
C898:69 01 8D 86 CC C9 0A D0 AB
C8A0:4D A9 00 8D 86 CC 18 AD 61
C8A8:85 CC 69 01 8D 85 CC C9 53
C8B0:0A D0 3B A9 00 8D 85 CC 8B
C8B8:18 AD 84 CC 69 01 8D 84 0E
C8C0:CC C9 0A D0 29 A9 00 8D F6
C8C8:84 CC 18 AD 83 CC 69 01 D0
C8D0:8D 83 CC C9 0A D0 17 A9 AB
C8D8:00 8D 83 CC 18 AD 82 CC 54
C8E0:69 01 8D 82 CC C9 0A D0 B3
C8E8:05 A9 00 8D 82 CC A0 05 CD
C8F0:B9 82 CC 18 69 30 99 00 5A
C8F8:05 A9 00 99 00 D9 88 D0 5A
C900:EF A9 11 8D 04 D4 AD 88 48
C908:CC C9 00 D0 11 AD 89 CC A0
C910:C9 00 D0 0A AD 8A CC C9 3E
C918:00 D0 03 4C 21 C9 4C 64 32
C920:C8 A9 10 8D 04 D4 A0 00 12
C928:20 FE CC A9 16 A0 CB 20 AA
C930:1E AB A9 00 85 C6 A5 C5 4B
C938:C9 27 F0 07 C9 19 D0 F6 54
C940:4C 5B C0 00 95 8F 88 82 67
C948:7D 77 71 6C 67 62 5D 58 45
C950:54 4F 4B 47 43 40 3C 38 8B
C958:35 32 2F 2C 29 26 24 21 07
C960:1F 1D 1B 18 17 15 13 11 F3
C968:10 0E 0D 0C 0B 0A 09 08 84
C970:07 06 05 04 04 03 03 02 1E
C978:02 01 01 01 01 00 00 00 85
C980:00 00 00 00 00 00 00 00 14
C988:00 00 00 00 00 00 00 01 1D
C990:01 01 01 01 01 01 01 01 24
C998:01 01 01 01 01 02 02 02 33
C9A0:02 02 02 02 02 02 02 02 34
C9A8:02 02 02 03 03 03 03 03 5B
C9B0:03 03 03 03 03 03 03 03 44
C9B8:03 04 04 04 04 04 04 04 CB
C9C0:04 04 04 04 04 04 04 04 54
C9C8:04 04 04 04 04 04 04 04 5C
C9D0:04 04 04 04 00 00 00 00 28
C9D8:01 01 01 01 01 01 01 02 6D
C9E0:02 02 02 02 03 03 03 03 83
C9E8:03 03 03 03 03 03 03 04 7D
C9F0:04 04 04 04 04 04 04 04 84
C9F8:04 04 05 05 05 05 05 05 CB
CA00:05 05 05 05 05 05 07 07 9B
CA08:07 07 07 07 07 07 07 07 9D
CA10:07 07 07 07 07 07 07 07 A5
CA18:07 07 04 04 04 04 04 04 EF
CA20:04 04 04 04 04 04 04 04 B5
CA28:04 04 04 04 04 03 03 03 B6
CA30:03 03 03 03 03 03 03 03 C5
CA38:03 02 02 02 02 02 01 01 4B
CA40:01 01 01 01 01 01 01 01 D5
CA48:01 00 00 00 00 00 00 00 5E
CA50:00 00 00 00 93 11 11 11 F9
CA58:11 11 11 11 11 90 20 43 3C
CA60:4F 50 59 52 49 47 48 54 4E
CA68:20 31 39 38 38 20 43 4F 1D
CA70:4D 50 55 54 45 21 20 50 EF
CA78:55 42 4C 49 43 41 54 49 78
CA80:4F 4E 53 0D 0D 20 20 20 D5
CA88:20 20 20 20 20 20 20 41 3F
CA90:4C 4C 20 52 49 47 48 54 D4
CA98:53 20 52 45 53 45 52 56 29
CAA0:45 44 0D 0D 20 20 20 20 3E
CAA8:20 20 20 20 20 20 20 9B B9
CAB0:43 4F 4D 50 55 54 45 52 43
CAB8:20 53 50 45 45 44 57 41 BC
CAC0:59 0D 0D 20 20 20 20 20 CB
CAC8:20 20 20 20 20 20 20 20 5E
CAD0:9B 50 52 45 53 53 20 41 50
CAD8:4E 59 20 4B 45 59 0D 0D 5B
CAE0:20 20 20 20 20 20 20 20 76
CAE8:20 20 20 20 20 20 54 4F 20 AD
CAF0:53 54 41 52 54 20 59 4F B7
CAF8:55 52 0D 0D 20 20 20 20 22
CB00:20 20 20 20 20 20 20 20 97
CB08:20 20 20 20 45 4E 47 49 F8
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CB10:4E 45 21 0D 0D 00 13 11 B4
CB18:11 11 11 11 11 11 11 20 BE
CB20:20 20 20 20 20 20 20 20 B7
CB28:20 20 20 50 4C 41 59 20 1B
CB30:41 47 41 49 4E 20 28 59 93
CB38:2F 4E 29 0D 0D 00 13 11 90
CB40:11 1D 1D 54 49 4D 45 20 BA
CB48:20 20 9D 9D 00 13 11 11 05
CB50:1D 1D 1D 1D 1D 1D 1D 1D E7
CB58:1D 1D 1D 1D 1D 1D 1D 1D EF
CB60:1D 20 20 4C 41 50 53 20 69
CB68:43 4F 4D 50 4C 45 54 45 89
CB70:44 20 00 20 20 A4 A4 AF C0
CB78:A4 AF AF B9 B9 A2 B9 B9 65
CB80:A2 A2 A2 B9 B9 B9 AF AF C5
CB88:B9 A2 A2 A2 B9 B9 AF A4 DC
CB90:A4 A4 20 20 20 20 20 20 8B
CB98:20 A4 A4 AF AF AF B9 B9 62
CBA0:B9 B9 AF AF A4 A4 A4 A4 1A
CBA8:A4 AF A4 A4 20 20 20 20 3F
CBB0:20 20 20 20 20 20 20 20 48
CBB8:20 20 20 20 20 20 20 20 50
CBC0:20 20 20 20 20 20 20 20 58
CBC8:20 20 20 20 20 20 20 20 60
CBD0:20 20 20 A4 A4 A4 AF AF 95
CBD8:A4 20 20 20 20 20 20 20 B2
CBE0:20 20 20 20 20 20 20 20 78
CBE8:20 20 20 A4 A4 A4 AF A4 A2
CBF0:A4 A4 AF AF AF B9 B9 A2 6F
CBF8:B9 AF B9 A2 A2 B9 AF B9 CF
CC00:AF A4 20 20 20 20 20 20 82
CC08:20 20 20 20 20 20 20 20 A1
CC10:20 20 20 20 20 20 20 20 A9
CC18:A4 A4 A4 A4 A4 A4 A4 A4 B1
CC20:AF AF AF B9 A2 B9 A2 B9 0A
CC28:B9 B9 AF A4 20 20 20 20 2F
CC30:20 20 20 20 20 20 20 20 C9
CC38:20 20 20 20 20 A4 A4 AF 7C
CC40:A4 AF AF B9 B9 A2 B9 B9 2F
CC48:A2 A2 A2 B9 B9 B9 AF AF 8F
CC50:B9 A2 A2 A2 B9 B9 AF A4 A6
CC58:A4 A4 20 20 20 20 20 20 55
CC60:20 A4 A4 00 00 00 00 00 C7
CC68:00 00 00 00 00 00 00 00 02
CC70:00 00 00 00 00 00 00 00 0A
CC78:00 00 00 00 00 00 00 00 12
CC80:00 00 00 00 00 00 00 00 1A
CC88:00 00 00 A0 00 A2 00 86 3D
CC90:FB A9 34 85 FC A9 0D 85 9F
CC98:FD A9 CD 85 FE B1 FD C9 32
CCA0:F9 F0 46 C9 FA D0 0A A9 B1
CCA8:00 91 FB 20 EC CC 4C E4 40
CCB0:CC C9 FB D0 0F A9 00 91 60
CCB8:FB 20 EC CC 91 FB 20 EC 6C
CCC0:CC 4C E4 CC C9 00 D0 17 44
CCC8:20 F3 CC B1 FD 8D FA CC 0D
CCD0:A9 00 91 FB 20 EC CC CE 4E
CCD8:FA CC D0 F6 4C E4 CC 91 CD
CCE0:FB 20 EC CC 20 F3 CC D0 26
CCE8:B4 4C 5B C0 E6 FB D0 02 32
CCF0:E6 FC 60 E6 FD D0 02 E6 D5
CCF8:FE 60 00 00 00 00 A9 4D CA
CD00:A0 CB 20 1E AB AE FB CC A1
CD08:A9 00 4C CD BD C0 FB C0 88
CD10:FB C0 00 39 F0 FB F0 FB C2
CD18:F0 FB F0 FB F0 FB F0 00 62
CD20:30 FC FB FC FB FC FB FC 2B
CD28:FB FC FB FC FB FC FB FC 19
CD30:FB FC 00 27 FF FB FF FB 67
CD38:FF FB FF FB FF FB FF FB 7E
CD40:FF FB FF FB FF FB FF FB 86
CD48:FF FB FF 00 1E FF C0 FA 50
CD50:FF C0 FA FF C0 FA FF C0 2E
CD58:FA FF C0 FA FF C0 FA FF 32
CD60:C0 FA FF C0 FA FF C0 FA 7B
CD68:FF C0 FA FF C0 FA FF C0 46
CD70:FA FF C0 FA FF C0 FA FF 4A
CD78:C0 00 36 E0 FA 0C 2C 20 C9
CD80:FA A0 E3 B0 80 A0 23 B3 C9
CD88:B0 2A AA 0C CA AA 0A 3B 6D
CD90:AA A8 02 EE 80 C2 AA CC 0C
CD98:00 25 02 CE FA 33 03 3B 90
CDA0:32 82 0A 0C CE 08 A0 AB 7B
CDA8:38 28 AA AC CA AA 83 3B CD
CDB0:BA CC 02 AE 80 00 22 13 63
CDB8:F1 FA 17 F5 FA 13 7D FA 68
CDC0:03 7C FA 0F AF FA 4F EF 45
CDC8:C4 4F FF C4 5F FF D4 43 CE
CDD0:FF 04 40 FA 04 00 22 04 8D
CDD8:FC 40 05 FD 40 04 DC 40 8F
CDE0:03 DF FA 03 EF FA 4F EF 7F
CDE8:C4 4F FF C4 5F FF D4 43 EE
CDF0:FF 04 40 FA 04 00 22 01 AA
CDF8:3F 10 01 7F 50 01 F7 10 D6
CE00:FA F7 FA 03 EB C0 4F EF 99
CE08:C4 4F FF C4 5F FF D4 43 10
CE10:FF 04 40 FA 04 00 22 01 CB
CE18:31 FA 01 75 FA 01 DD FB 18
CE20:EC FA 13 EF 10 13 FF 10 31
CE28:17 FF 50 10 FC 10 10 FA 9F
CE30:10 00 26 44 FB 74 FB EC 75
CE38:FA 04 FC 40 05 FD 40 04 9C
CE40:FC 40 00 2F 44 FB 74 FA 55
CE48:01 ED FA 01 FD FA 01 FD 2D
CE50:00 33 74 FA 01 ED FA 01 AF
CE58:FD 00 39 30 FB 74 00 3C 0D
CE60:10 00 1D F9 00 00 00 00 49
```

BEFORE TYPING . . .

Before typing in programs, please refer to "How to Type In COMPUTE!'s GAZETTE Programs," elsewhere in this issue.

Ramdisk 128

Article on page 76.

Program 1: Loader

```
HE 10 REM COPYRIGHT 1988 COMPU
      TE! PUBLICATIONS, INC. -
       ALL RIGHTS RESERVED
KF 20 POKE58,96:CLR
XP 30 PRINT"{CLR}{3 SPACES}COP
      YRIGHT 1988 COMPUTE! PUB
      ., INC.":PRINTTAB(11)"AL
      L RIGHTS RESERVED"
RS 40 FORI=1TO96:READA:X=X+A:N
      EXT:IFX<>11932 7THENPRINT
      "DATA STATEMENT ERROR.":
      STOP
SC 50 SA=DEC("1300"):BLOAD"128
      -RAMDISK",P(SA)
KS 60 IFSA=DEC("1300")THEN90:E
      LSEDEFFNHI(X)=INT(X/256)
      :DEFFNLO(X)=X-(INT(X/256
      )*256):RESTORE
HA 70 FORI=1TO6:READA,B,C:POKE
      SA+A,FNLO(SA+B):POKESA+C
      ,FNHI(SA+B):NEXTI
GX 80 FORI=1TO39:READA,B:POKES
      A+A,FNLO(SA+B):POKESA+A+
      1,FNHI(SA+B):NEXTI
GK 90 SYS(SA)
CP 100 END
MK 110 REM --- RELOCATION DATA
       ---
EP 120 DATA 53,2143,58,63,2190
       ,68,73,2229,78
GD 130 DATA 2010,2265,2012,214
       6,2168,2148,2211,2168,2
       207
QJ 140 DATA 94,1749,159,536,17
       3,447,241,1522,273,784
GD 150 DATA 284,2020,289,468,3
       09,928,534,88,618,1522,
       640,784
KH 160 DATA 776,0,2241,2253,22
       46,2253,801,1082,911,20
       67
BC 170 DATA 916,468,1025,311,1
       080,373,1257,1472,1300,
       1492
AQ 180 DATA 1452,1288,1470,128
       3,1542,1747,1745,1566
GR 190 DATA 1755,1900,1760,198
       5,1901,0,1906,1985,1911
       ,1766
MF 200 DATA 2202,2225,424,405,
       712,663,2237,2261,1206,
       1472
PX 210 DATA 2253,82,2255,527,2
       257,1086,2259,763
```

Program 2: 128-RAMDISK

See program listing on page 76 before typing in.

```
1300:A9 00 8D C9 0A A9 68 8D 9E
1308:CA 0A A9 00 8D CB 0A 85 80
1310:FB A9 60 8D CC 0A 85 FC 1A
1318:A9 FB 8D B9 02 A2 01 A0 9C
1320:00 98 20 77 FF A9 00 8D 1C
1328:C8 0A A9 F0 8D C6 0A A9 BE
1330:96 8D C7 0A A9 5F 8D 0C 90
1338:03 A9 1B 8D 0D 03 A9 8E DC
1340:8D 0E 03 A9 1B 8D 0F 03 DB
1348:A9 B5 8D 10 03 A9 1B 8D E5
1350:11 03 60 A9 00 8D DA 0A 5C
1358:20 86 03 D0 03 4C D5 19 AB
1360:20 96 AF A0 00 A5 64 85 21
1368:FB A5 65 85 FC A5 63 C9 0A
1370:10 90 02 A9 0F 85 FA C9 EB
1378:00 D0 05 A2 08 6C 00 03 92
1380:A5 66 A4 67 20 E0 87 20 D1
1388:86 03 F0 08 A9 01 8D D6 94
1390:0A 18 90 05 A9 00 8D D6 63
1398:0A AD DA 0A F0 03 4C 18 6F
13A0:15 AD CC 0A C9 67 90 10 14
13A8:C9 44 D0 03 4C BF 14 AD 46
13B0:CB 0A C9 C0 90 02 B0 F4 67
13B8:A5 7F D0 07 A0 51 20 1E C4
13C0:F7 A0 00 A9 FB A2 01 20 32
13C8:74 FF A6 7F E0 00 D0 03 A1
13D0:20 D2 FF 99 B7 12 C8 C4 B1
13D8:FA D0 E8 A6 7F E0 00 D0 88
13E0:05 A9 0D 20 D2 FF A9 00 81
13E8:99 B7 12 A9 01 8D D5 0A 9A
13F0:20 F2 18 B0 16 20 7D FF 1E
13F8:0D 46 49 4C 45 20 45 58 B2
1400:49 53 54 53 0D 00 A2 80 8F
1408:6C 00 03 AD D6 0A F0 03 65
1410:4C 10 16 A5 2D 85 FB A5 9C
1418:2E 85 FC 20 E4 1A 90 03 0E
1420:4C D4 14 AD 10 12 8D D9 BE
1428:0A AD 11 12 8D DA 0A A9 99
1430:08 8D DB 0A 4C A0 16 A9 96
1438:00 8D DB 0A AD CB 0A 85 16
1440:FB AD CC 0A 85 FC A0 00 6D
1448:A9 FB 8D B9 02 A9 01 AA F4
1450:20 77 FF C8 A2 01 AD D0 38
1458:0A 20 77 FF C8 A2 01 AD FC
1460:D1 0A 20 77 FF C8 A2 01 D8
1468:A5 2D 20 77 FF C8 A2 01 93
1470:A5 2E 20 77 FF A2 01 A0 9F
1478:05 AD C9 0A 20 77 FF C8 10
1480:A2 01 AD CA 0A 20 77 FF 5C
1488:C8 A5 FD 8D C9 0A A5 FE D7
1490:8D CA 0A A2 00 BD B7 12 16
1498:86 FA A2 01 20 77 FF C8 CE
14A0:A6 FA E8 C9 00 F0 03 4C AA
14A8:95 14 AD CB 0A 18 69 18 AE
14B0:8D CB 0A 90 37 EE CC 0A F5
14B8:AD CC 0A C9 68 90 2D 20 C8
14C0:7D FF 0D 44 49 52 45 43 EE
14C8:54 4F 52 59 20 46 55 4C DF
14D0:4C 0D 00 60 AD DC 0A D0 2E
14D8:12 20 7D FF 0D 52 41 4D 43
14E0:44 49 53 4B 20 46 55 4C AD
14E8:4C 0D 00 60 AD CB 0A 85 B6
14F0:FB AD CC 0A 85 FC A9 FB 2C
14F8:8D 89 02 A2 01 A0 00 98 D7
1500:20 77 FF AD CE 0A 8D C6 73
1508:0A AD CF 0A 8D C7 0A 60 3D
1510:A9 01 8D DA 0A 4C 58 13 F3
1518:A0 00 A5 7F D0 0A A0 49 78
```

```
1520:20 1E F7 A9 20 20 D2 FF A2
1528:A0 00 A5 63 C9 10 90 02 3F
1530:A9 0F 85 FA A5 64 85 FB 19
1538:A5 65 85 FC A9 FB A2 01 92
1540:20 74 FF A6 7F E0 00 D0 52
1548:03 20 D2 FF 99 B7 12 C8 EE
1550:C4 FA D0 E8 A6 7F E0 00 39
1558:D0 05 A9 0D 20 D2 FF A9 28
1560:00 99 B7 12 A9 00 8D D5 47
1568:0A 20 F2 18 90 05 A2 04 61
1570:6C 00 03 AD DB 0A C9 01 A7
1578:F0 08 A9 07 8D DB 0A 4C FE
1580:10 16 A5 2D 85 FD A5 2E 5D
1588:85 FE A9 FD 8D B9 02 A0 42
1590:00 8C CE 0A 8C CF 0A A9 B9
1598:FB A2 01 20 74 FF A2 00 74
15A0:20 77 FF EE CE 0A AD CE 70
15A8:0A D0 03 EE CF 0A AD CE 2C
15B0:0A CD D9 0A D0 0A AD CF 09
15B8:0A CD DA 0A D0 02 F0 0A D1
15C0:C8 D0 D4 E6 FC E6 FE 4C 5A
15C8:97 15 AD DA 0A C9 02 D0 B3
15D0:01 60 C8 84 FA A5 FD 18 77
15D8:65 FA 90 02 E6 FE 8D 10 05
15E0:12 A5 FE 8D 11 12 20 87 CE
15E8:AF 60 AD D7 0A 85 FD AD 46
15F0:D8 0A 85 FE A9 00 8D DB EE
15F8:0A 18 90 8E D0 0D 20 E1 06
1600:A7 F0 04 C9 59 D0 03 20 8D
1608:00 13 60 A2 0B 6C 00 03 3C
1610:20 86 03 C9 2C F0 0C AD D5
1618:DB 0A C9 07 D0 02 F0 CA 99
1620:4C 3A 17 20 80 03 20 96 CC
1628:AF 20 0C AF A5 16 8D D7 29
1630:0A A5 17 8D D8 0A AD DB AC
1638:0A C9 07 D0 02 F0 DF 20 7D
1640:86 03 D0 02 F0 DA C9 2C 5D
1648:F0 02 F0 D4 20 80 03 20 02
1650:96 AF 20 0C AF A5 16 8D 46
1658:D9 0A A5 17 8D DA 0A AD B3
1660:D8 0A CD DA 0A 90 0F D0 64
1668:08 AD D7 0A CD D9 0A 90 1A
1670:05 A2 0E 6C 00 03 AD D7 8F
1678:0A 8D CE 0A AD D8 0A 8D F9
1680:CF 0A AD D9 0A 8D D0 0A 9C
1688:AD DA 0A 8D D1 0A 20 13 66
1690:1B 90 03 4C D4 14 AD D7 BD
1698:0A 85 FB AD D8 0A 85 FC 7C
16A0:A0 00 AD C9 0A 85 FD AD 7F
16A8:CA 0A 85 FE A9 FD 8D B9 77
16B0:02 A9 FB A2 00 20 74 FF 5B
16B8:A2 01 20 77 FF C8 D0 04 BA
16C0:E6 FC E6 FE A5 FB 8D DD 82
16C8:0A A5 FC 8D DE 0A 98 18 44
16D0:6D DD 0A 90 03 EE DE 0A 11
16D8:CD D9 0A D0 D4 AD DE 0A D5
16E0:CD DA 0A 90 CC AD CB 0A B3
16E8:85 FB AD CC 0A 85 FC 98 52
16F0:18 65 FD 85 FD 90 02 E6 B7
16F8:FE AD DB 0A C9 08 D0 03 3F
1700:4C 37 14 A0 00 A9 FB 8D DA
1708:B9 02 A9 02 AA CA 20 77 21
1710:FF A0 03 AD D7 0A A2 01 CE
1718:20 77 FF C8 AD D8 0A A2 48
1720:01 20 77 FF A0 01 A2 01 15
1728:AD D0 0A 20 77 FF C8 A2 94
1730:01 AD D1 0A 20 77 FF 4C 50
1738:75 14 A2 0B 4C 3F 4D A9 CE
1740:00 8D 00 FF AD 20 D0 8D EE
1748:D2 0A AD 21 D0 8D D3 0A 98
1750:A5 F1 8D D4 0A A9 06 8D 5D
1758:20 D0 8D 21 D0 20 7D FF 90
1760:13 13 93 9F 31 32 38 2D 39
1768:52 41 4D 44 49 53 4B 20 4C
1770:44 49 52 45 43 54 4F 52 0E
1778:59 20 20 20 20 20 20 20 43
1780:20 20 42 59 54 45 53 20 23
1788:46 52 45 45 9E 00 A2 00 A5
1790:A0 17 18 20 F0 FF AD C6 83
1798:0A 85 60 AD C7 0A 85 61 E6
17A0:AD C8 0A 85 62 20 07 BA CD
17A8:A9 00 A2 08 A0 03 20 5D 2F
17B0:BA A2 01 A0 00 20 C0 18 29
17B8:20 7D FF 46 49 4C 45 4E 0F
17C0:41 4D 45 20 20 20 20 20 6F
17C8:20 20 20 20 20 20 20 20 F6
17D0:20 20 20 20 53 54 41 52 DD
17D8:54 20 20 20 4C 45 4E 47 9A
17E0:54 48 0D 00 A2 03 A0 00 4F
17E8:20 C0 18 A9 04 A2 00 18 B7
17F0:20 2D C0 A9 18 A2 27 38 FE
17F8:20 2D C0 A9 00 85 FB A9 EC
1800:60 85 FC A9 13 8D CD 0A 70
1808:A0 00 A9 FB A2 01 20 74 4B
1810:FF D0 03 4C D4 18 A0 07 E8
1818:A9 FB A2 01 20 74 FF 20 73
1820:D2 FF F0 04 C8 18 90 F0 D0
1828:A9 20 C0 20 B0 07 20 D2 04
1830:FF C8 18 90 F5 A0 03 A2 79
1838:01 A9 FB 20 74 FF 85 60 E3
1840:C8 A2 01 A9 FB 20 74 FF 81
1848:85 61 A9 00 85 62 20 07 C5
1850:BA A9 00 A2 08 A0 03 20 5B
1858:5D BA 38 20 F0 FF A0 21 D8
1860:18 20 F0 FF A0 01 A2 01 12
1868:A9 FB 20 74 FF 85 60 C8 57
1870:A2 01 A9 FB 20 74 FF 85 7F
1878:61 A9 00 85 62 20 07 BA 78
1880:A9 00 A2 08 A0 03 20 5D 09
1888:BA A9 0D 20 D2 FF 18 A5 90
1890:FB 69 18 85 FB 90 0A E6 91
1898:FC A5 FC C9 68 D0 02 F0 68
18A0:33 CE CD 0A F0 08 20 E1 42
18A8:FF F0 29 4C 08 18 20 E1 C1
18B0:FF F0 26 20 E4 FF F0 F6 E3
18B8:A9 93 20 D2 FF 4C 03 18 23
18C0:18 20 F0 FF A9 C0 A0 28 DC
18C8:20 D2 FF 88 D0 FA A9 0D 19
18D0:20 D2 FF 60 20 E4 FF F0 51
18D8:FB AD D2 0A 8D 20 D0 AD A9
18E0:D3 0A 8D 21 D0 AD D4 0A 32
18E8:85 F1 20 7D FF 13 13 93 3A
18F0:00 60 A9 00 85 FD A9 60 46
18F8:85 FE A0 00 A9 FD A2 01 4B
1900:20 74 FF D0 03 4C D3 19 76
1908:A0 07 A2 01 A9 FD 20 74 AA
1910:FF A0 00 D9 B7 12 F0 19 09
1918:B9 B7 12 C9 2A D0 04 48 D8
1920:18 90 3F A5 FD 18 69 18 FF
1928:85 FD 90 02 E6 FE 18 90 C2
1930:C9 A0 01 84 FA A0 08 8C CE
1938:CD 0A A2 01 AC CD 0A C0 A9
1940:18 B0 20 A9 FD 20 74 FF A2
1948:F0 7F EE CD 0A 48 A4 FA 43
1950:B9 B7 12 C9 2A F0 0B 68 BF
1958:D9 B7 12 D0 C6 E6 FA 18 94
1960:90 D8 68 AD D5 0A F0 0E BF
1968:AC CD 0A A2 01 A9 FD 20 9A
1970:74 FF F0 53 38 60 A0 05 B9
1978:A2 01 A9 FD 20 74 FF 85 A9
1980:FB C8 A2 01 A9 FD 20 74 41
1988:FF 85 FC A0 00 A2 01 A9 FB
1990:FD 20 74 FF 8D DB 0A 8D D5
1998:DA 0A C8 A2 01 A9 FD 20 C8
19A0:74 FF 8D D9 0A C8 A2 01 16
19A8:A9 FD 20 74 FF 8D DA 0A 70
19B0:A0 03 A2 01 A9 FD 20 74 52
19B8:FF 8D D7 0A C8 A2 01 A9 66
19C0:FD 20 74 FF 8D D8 0A 18 84
19C8:60 A4 FA D9 B7 12 F0 93 CC
19D0:4C 23 19 38 60 AD DA 0A 12
19D8:F0 03 4C 6C 1A A0 0C 20 20
19E0:C1 1A B0 02 90 0C AA A9 64
19E8:02 20 C3 FF 20 CC FF 6C 3D
19F0:00 03 A0 51 20 1E F7 A9 20
19F8:0D 20 D2 FF A2 02 20 C9 3B
1A00:FF A2 00 BD C6 0A 20 D2 2A
1A08:FF E8 E0 07 90 F5 A9 60 13
1A10:85 FC A9 00 85 FB A8 AE 97
1A18:CA 0A E8 8E DB 0A A2 01 87
1A20:A9 FB 20 74 FF 20 D2 FF 99
1A28:20 B7 FF D0 12 C8 D0 EE AB
1A30:E6 FC A5 FC CD DB 0A D0 5E
1A38:E5 A9 08 20 4A FF 60 A9 89
1A40:02 20 C3 FF 20 CC FF A9 D3
1A48:0D 20 D2 FF 20 78 A7 A0 38
1A50:00 A9 7B A2 01 20 74 FF F9
1A58:F0 07 20 D2 FF C8 18 90 DB
1A60:F0 A9 0D 20 D2 FF A9 08 0D
1A68:20 4A FF 60 20 00 13 A0 0D
1A70:08 20 C1 1A 90 03 4C E6 9A
1A78:19 A0 49 20 1E F7 A9 0D BD
1A80:20 D2 FF A2 02 20 C6 FF C1
1A88:A2 00 20 E4 FF 9D C6 0A 6E
1A90:E8 E0 07 90 F5 A9 60 85 F7
1A98:FC A9 00 85 FB A8 A9 FB DF
1AA0:8D 89 02 20 E4 FF A2 01 AD
1AA8:20 77 FF 20 B7 FF D0 0B 37
1AB0:C8 D0 F0 E6 FC A5 FC C9 4C
1AB8:FF D0 E8 A9 08 20 4A FF 2E
1AC0:60 84 FA A9 00 8D 00 FF 76
1AC8:A9 02 A8 A2 08 20 BA FF C7
1AD0:A9 01 A2 00 20 68 FF A5 B6
1AD8:FA A2 D9 A0 1B 20 BD FF 4D
1AE0:20 C0 FF 60 A5 2D 8D CE 27
1AE8:0A A5 2E 8D CF 0A A9 00 24
1AF0:8D DC 0A AD 10 12 8D D0 F3
1AF8:0A AD 11 12 8D D1 0A CD 76
1B00:CF 0A D0 0F AD D0 0A ED 5E
1B08:CE 0A C9 03 B0 05 EE DC E5
1B10:0A 38 60 AD D0 0A 38 ED 4D
1B18:CE 0A B0 03 CE D1 0A 8D DD
1B20:D0 0A AD D1 0A 38 ED CF F0
1B28:0A 8D D1 0A AD C6 0A 8D CB
1B30:CE 0A AD C7 0A 8D CF 0A B2
1B38:AD CE 0A 38 ED D0 0A 8D 12
1B40:CE 0A B0 0B AD CF 0A 38 20
1B48:E9 01 8D CF 0A 90 0E AD BE
1B50:CF 0A 38 ED D1 0A 90 05 B3
1B58:8D CF 0A 18 60 38 60 85 36
1B60:02 A0 78 A9 1B 20 E2 43 CB
1B68:90 08 69 A6 A2 00 18 4C 12
1B70:21 43 38 A5 02 4C 21 43 30
1B78:45 53 41 56 C5 45 4C 4F DE
1B80:41 C4 45 44 49 D2 45 48 DD
1B88:45 41 44 45 D2 00 E0 00 E6
1B90:D0 1B C9 2B B0 17 E9 26 BD
1B98:A8 B9 B1 1B 85 24 A9 1B A4
1BA0:85 25 A9 78 18 65 24 90 CE
1BA8:02 E6 25 85 24 18 4C CD 7E
1BB0:51 00 05 0A 0E C9 2B B0 6F
1BB8:10 E9 26 A8 B9 D5 1B A8 C4
1BC0:B9 CD 1B 48 88 B9 CD 1B 11
1BC8:48 18 4C A9 4B 52 13 0F 26
1BD0:15 3E 17 FB 15 01 03 05 7B
1BD8:07 52 41 4D 46 49 4C 45 59
1BE0:53 2C 50 2C 57 00 00 00 53
```

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," elsewhere in this issue.

Speed File For The 64

See program listing on page 66 before typing in.

```
0801:0B 08 0A 00 9E 32 30 36 2E
0809:31 00 00 00 20 67 09 4C AE
0811:AB 09 90 13 12 20 20 20 ED
0819:20 20 20 20 44 45 53 49 6E
0821:47 4E 20 59 4F 55 52 20 96
0829:53 43 52 45 45 4E 20 46 3C
0831:4F 52 4D 41 54 20 20 20 BE
0839:20 20 20 20 20 1F 20 20 45
0841:20 20 20 20 20 20 20 50 81
0849:52 45 53 53 20 5E 20 57 85
0851:48 45 4E 20 46 49 4E 49 DF
0859:53 48 45 44 20 20 20 20 F3
0861:20 20 20 20 20 20 92 90 C6
0869:0D 00 90 13 11 20 20 20 AC
0871:20 4D 41 49 4E 20 4D 45 74
0879:4E 55 20 2D 20 50 52 45 09
0881:53 53 20 4B 45 59 20 54 EC
```

```
 889:4F 20 53 45 4C 45 43 54 5A
 891:0D 81 11 11 11 20 20 20 25
 899:20 44 20 2D 20 44 45 53 91
 8A1:49 47 4E 20 4E 45 57 20 4A
 8A9:46 49 4C 45 0D 11 20 20 1A
 8B1:20 20 52 20 2D 20 52 45 F9
 8B9:41 44 20 46 49 4C 45 20 0A
 8C1:46 52 4F 4D 20 44 49 53 40
 8C9:4B 0D 11 20 20 20 20 57 FF
 8D1:20 2D 20 57 52 49 54 45 5C
 8D9:20 43 55 52 52 45 4E 54 33
 8E1:20 46 49 4C 45 20 54 4F 24
 8E9:20 44 49 53 4B 0D 11 20 4A
 8F1:20 20 20 46 20 2D 20 46 BE
 8F9:55 4E 43 54 49 4F 4E 20 3A
 901:4D 45 4E 55 0D 11 20 20 37
 909:20 20 50 20 2D 20 50 52 1C
 911:49 4E 54 20 46 49 4C 45 1D
 919:0D 11 20 20 20 20 53 20 44
 921:2D 20 53 4F 52 54 20 46 9B
 929:49 4C 45 0D 11 20 20 20 D5
 931:20 51 20 2D 20 51 55 49 B8
 939:54 0D 11 20 20 20 20 24 C2
 941:20 2D 20 44 49 53 4B 20 45
 949:44 49 52 45 43 54 4F 52 CA
 951:59 0D 11 20 20 20 20 1F 58
 959:12 46 52 45 45 20 42 59 2D
 961:54 45 53 3A 20 00 AD 34 8D
 969:11 8D 33 2C 8D 37 2C AD DF
 971:35 11 8D 38 2C 8D 34 2C C3
 979:A2 01 8E F1 1E 20 24 21 E8
 981:A9 08 20 D2 FF A9 8E 20 7F
 989:D2 FF A0 36 84 01 A9 80 78
 991:85 9D 8D 8A 02 A0 17 A9 92
 999:00 99 B0 27 88 D0 FA 85 9D
 9A1:02 8D 86 02 8D AC 17 60 B6
 9A9:AB 09 20 D9 09 AD A9 09 D0
 9B1:8D 00 03 AD AA 09 8D 01 5B
 9B9:03 A0 00 B9 6B 08 F0 07 75
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1871:11 11 11 11 11 11 11 11 A1
1879:11 12 53 45 4C 45 43 54 C7
1881:20 50 52 49 4D 41 52 59 22
1889:20 53 4F 52 54 20 46 49 A6
1891:45 4C 44 90 00 81 13 11 46
1899:11 11 11 11 11 11 11 11 C9
18A1:11 11 11 11 11 11 11 11 D1
18A9:11 11 11 11 11 11 11 12 DA
18B1:53 45 4C 45 43 54 20 53 B9
18B9:45 43 4F 4E 44 20 53 4F C4
18C1:52 54 20 46 49 45 4C 44 D4
18C9:20 90 00 93 1F 11 11 20 E6
18D1:20 53 4F 52 54 49 4E 47 A1
18D9:2E 2E 2E 90 00 20 95 12 39
18E1:20 C3 14 20 3A 11 20 56 44
18E9:11 20 F1 0A C9 11 F0 0B 09
18F1:C9 5E F0 1B C9 0D F0 3C 0F
18F9:4C EA 18 20 73 11 AC 39 82
1901:11 CC 30 2C F0 DD EE 39 CD
1909:11 20 53 11 4C EA 18 AE 34
1911:AA 17 AD 39 11 9D A7 17 0D
1919:E8 E0 02 F0 14 8E AA 17 8E
1921:A0 00 B9 96 18 F0 07 20 F6
1929:D2 FF C8 4C 23 19 4C EA A3
1931:18 4C 40 19 AE A7 17 F0 4F
1939:03 4C 40 19 4C AB 09 A0 5D
1941:36 B9 96 18 F0 07 20 D2 08
1949:FF C8 4C 42 19 A2 01 8E 3F
1951:AB 17 20 95 12 4C 9F 19 96
1959:AC A7 17 BE F0 2B 8E AA 96
1961:17 BE E0 2B AC AA 17 B1 8D
1969:FD D1 4E F0 05 90 1A 4C D2
1971:9F 19 C8 CA F0 03 4C 68 14
1979:19 AC A8 17 F0 20 AE A9 F8
1981:17 D0 1B 8C A9 17 4C 5C 3E
1989:19 A0 00 8C AB 17 B1 FD 54
1991:48 B1 4E 91 FD 68 91 4E 3A
1999:C8 CC 32 2C D0 F0 A9 00 0A
19A1:8D A9 17 AD 76 12 85 4E 18
19A9:AD 77 12 85 4F 20 D2 12 DD
19B1:20 AC 12 20 07 17 90 06 1F
19B9:20 FC 16 4C 59 19 AD AB F8
19C1:17 F0 03 4C AB 09 4C 4E 49
19C9:19 A0 00 B9 27 1A F0 07 D6
19D1:20 D2 FF C8 4C CC 19 60 7D
19D9:A9 08 A2 08 A0 01 20 BA BB
19E1:FF 60 A0 00 20 CF FF 99 1A
19E9:00 02 C8 C9 0D D0 F5 88 72
19F1:F0 09 98 A2 00 A0 02 20 C2
19F9:BD FF 60 68 68 4C AB 09 72
1A01:A9 D0 85 4E A9 27 85 4F 18
1A09:A9 4E AE 33 2C AC 34 2C 57
1A11:20 D8 FF 60 A9 00 A2 78 9C
1A19:A0 2B 20 D5 FF B0 06 8E 27
1A21:33 2C 8C 34 2C 60 93 53 2C
1A29:41 56 45 3A 00 93 4C 4F 16
1A31:41 44 3A 00 20 CA 19 20 DC
1A39:E3 19 20 D9 19 20 01 1A AC
1A41:B0 03 20 4C 1A 20 86 1B D0
1A49:4C AB 09 A5 B7 85 02 A0 82
1A51:00 B1 BB 99 B0 27 C8 C4 7B
1A59:02 F0 03 4C 52 1A 60 4C F7
1A61:29 0C A4 02 D0 F9 20 67 F7
1A69:09 A0 07 20 CC 19 20 E3 1C
1A71:19 20 D9 19 20 15 1A B0 41
1A79:03 20 4C 1A 20 86 1B 4C FF
1A81:AB 09 A0 00 B9 1F 1B F0 53
1A89:07 20 D2 FF C8 4C 85 1A 40
1A91:A9 01 A2 08 A0 00 20 BA AF
1A99:FF A9 01 AE A8 1A AC A9 F3
1AA1:1A 20 BD FF 4C AB 1A AA 92
1AA9:1A 24 20 C0 FF A2 01 20 B0
1AB1:C6 FF 4C D9 1A 20 CF FF 61
1AB9:48 A5 90 29 BF F0 06 68 56
1AC1:68 68 4C C8 1A 68 60 20 AD
1AC9:CC FF A9 01 20 C3 FF 20 D9
1AD1:E4 FF 20 F1 0A 4C AB 09 7D
1AD9:20 B6 1A 20 B6 1A 20 B6 26
1AE1:1A 20 B6 1A F0 E1 20 CC BF
1AE9:FF 20 E4 FF C9 20 D0 03 36
1AF1:20 F1 0A A2 01 20 C6 FF 34
1AF9:20 B6 1A 48 20 B6 1A A8 6C
1B01:68 AA 98 20 09 21 A9 20 6B
1B09:20 D2 FF 20 B6 1A F0 06 0C
1B11:20 D2 FF 4C 0C 1B A9 0D FD
1B19:20 D2 FF 4C DF 1A 93 44 AB
1B21:49 53 4B 20 44 49 52 45 6D
1B29:43 54 4F 52 59 0D 50 52 17
1B31:45 53 53 20 53 50 41 43 EC
1B39:45 20 54 4F 20 50 41 55 B3
1B41:53 45 20 4F 52 20 45 58 61
1B49:49 54 0D 00 A9 13 20 D2 87
1B51:FF A9 0F A2 08 A0 0F 20 FE
1B59:BA FF A9 00 20 BD FF 20 3A
1B61:C0 FF A2 0F 20 C6 FF 4C A5
1B69:75 1B 20 CF FF C9 0D F0 54
1B71:06 20 D2 FF 4C 6B 1B 20 73
1B79:CC FF A9 0F 20 C3 FF A0 EC
1B81:00 8D AC 17 60 A9 01 8D 5B
1B89:AC 17 60 20 D9 09 A5 02 2A
1B91:F0 03 4C D5 1C 4C 38 0F 79
1B99:13 11 9C 12 20 20 20 20 34
1BA1:20 20 20 20 20 20 20 20 D7
1BA9:20 20 50 52 49 4E 54 45 98
1BB1:52 20 4D 45 4E 55 20 20 3F
1BB9:20 20 20 20 20 20 20 20 EF
1BC1:20 20 20 20 0D 11 11 1F 04
1BC9:20 20 20 53 20 2D 20 53 9A
1BD1:45 4E 44 20 50 52 49 4E 75
1BD9:54 45 52 20 43 4F 4D 4D 17
1BE1:41 4E 44 53 0D 11 20 20 17
1BE9:20 45 20 2D 20 45 4E 54 5F
1BF1:45 52 2F 45 44 49 54 20 A9
1BF9:48 45 41 44 49 4E 47 20 44
1C01:49 4E 46 4F 2E 0D 11 20 17
1C09:20 20 50 20 2D 20 50 52 42
1C11:49 4E 54 20 52 45 43 4F 8B
1C19:52 44 53 0D 11 20 20 20 30
1C21:4C 20 2D 20 4C 41 42 45 60
1C29:4C 20 50 52 49 4E 54 45 30
1C31:52 0D 11 20 20 20 58 20 4C
1C39:2D 20 45 58 49 54 0D 00 F3
1C41:13 90 12 11 20 20 20 20 5C
1C49:20 20 20 20 20 45 4E 54 A6
1C51:45 52 20 43 4F 4C 55 4D 9C
1C59:4E 20 48 45 41 44 49 4E 1A
1C61:47 53 20 20 20 20 20 20 F9
1C69:20 20 20 20 0D 00 13 90 DE
1C71:12 20 20 20 20 20 20 20 A2
1C79:20 20 20 45 4E 54 45 52 C2
1C81:20 43 4F 4C 55 4D 4E 20 E5
1C89:4E 55 4D 42 45 52 53 20 46
1C91:20 20 20 20 20 20 20 20 C9
1C99:20 9C 3C 52 45 54 55 52 2E
1CA1:4E 3E 20 2D 20 4E 45 58 84
1CA9:54 20 46 49 45 4C 44 20 75
1CB1:81 2B 2F 2D 2F 30 20 2D D5
1CB9:20 41 44 4A 55 53 54 20 40
1CC1:54 41 42 92 90 0D 00 B9 58
1CC9:99 1B F0 07 20 D2 FF C8 39
1CD1:4C C8 1C 60 20 D9 09 A0 07
1CD9:00 20 C8 1C A2 01 8E F1 1D
1CE1:1E 20 F1 0A C9 53 F0 13 A0
1CE9:C9 45 F0 12 C9 50 F0 11 1A
1CF1:C9 58 F0 13 C9 4C F0 0C E1
1CF9:4C E2 1C 4C 9B 1D 4C F3 37
1D01:1E 4C EE 1F 4C 21 22 4C A4
1D09:AB 09 90 43 4F 4D 4D 41 2D
1D11:4E 44 3A 00 93 90 45 4E 82
1D19:54 45 52 20 50 52 49 4E C7
1D21:54 45 52 20 43 4F 44 45 48
1D29:53 20 41 53 20 44 45 43 52
1D31:49 4D 41 4C 20 4E 55 4D 82
1D39:42 45 52 53 0D 11 50 52 05
1D41:45 53 53 20 52 45 54 55 05
1D49:52 4E 20 57 49 54 48 20 06
1D51:4E 4F 20 45 4E 54 52 59 A0
1D59:20 54 4F 20 45 58 49 54 17
1D61:20 41 4E 44 20 20 53 45 77
1D69:4E 44 20 54 48 45 20 53 10
1D71:54 52 49 4E 47 20 54 4F 2B
1D79:20 54 48 45 20 50 52 49 66
1D81:4E 54 45 52 0D 0D 00 B9 1C
1D89:0B 1D F0 07 20 D2 FF C8 34
1D91:4C 88 1D 60 A0 00 20 88 8B
1D99:1D 60 A0 0A 20 88 1D A2 2F
1DA1:00 8E E5 1D 20 10 1E B0 3C
1DA9:15 AE E5 1D E0 0D F0 0B D0
1DB1:E8 8E E5 1D 98 9D E5 1D B6
1DB9:4C A5 1D 4C 9B 1D AE E5 80
1DC1:1D E8 A9 0D 9D E5 1D E8 72
1DC9:A9 00 9D E5 1D 20 F5 1D 5D
1DD1:A0 01 B9 E5 1D F0 07 20 0D
1DD9:D2 FF C8 4C D3 1D 20 0A B8
1DE1:1E 4C D5 1C 01 0D 0D 00 11
1DE9:0D 00 FF 60 20 E7 FF 60 B1
1DF1:3B 1E A9 0D A9 00 20 BD A2
1DF9:FF A9 04 A8 AA 20 BA FF F4
1E01:20 C0 FF A2 04 20 C9 FF DB
1E09:60 20 E7 FF 60 58 1E A9 C4
1E11:0D 20 D2 FF 20 95 1D A0 68
1E19:00 20 CF FF 99 00 02 C8 F0
1E21:C9 0D D0 F5 88 F0 2A A9 05
1E29:00 85 7A A9 02 85 7B A0 6E
1E31:37 84 01 AD 0E 1E 8D 00 29
1E39:03 AD 0F 1E 8D 01 03 BA 57
1E41:8E 64 1E 20 9E AD A5 0D A7
1E49:D0 0D 20 AA B1 18 4C 53 B9
1E51:1E 38 A2 36 86 01 60 AE 0A
1E59:64 1E 9A A9 91 20 D2 FF EF
1E61:4C 10 1E 00 AE 30 2C 8E A8
1E69:A6 17 A0 00 8C A5 17 BD B9
1E71:00 2C CD A5 17 F0 0F CA 32
1E79:F0 03 4C 70 1E 88 F0 16 8A
1E81:AE 30 2C 4C 6D 1E 8A AE 13
1E89:A6 17 9D 10 2C AA CE A6 E3
1E91:17 F0 03 4C 78 1E A2 01 3D
1E99:8E 39 11 8E F0 1E AE 39 0D
1EA1:11 BD 10 2C A8 B9 00 2C F2
1EA9:F0 21 8D EF 1E 38 ED F0 F5
1EB1:1E 90 38 99 20 2C B9 E0 C7
1EB9:2B 18 6D EF 1E 8D F0 1E 65
1EC1:EE 39 11 AE 30 2C EC 39 16
1EC9:11 B0 D3 AE 30 2C BC 10 DB
1ED1:2C B9 00 2C D0 06 CA F0 7A
1ED9:0A 4C CF 1E 18 79 E0 2B 9D
1EE1:4C E6 1E A9 00 8D 00 2C BE
1EE9:4C 2F 21 4C 2B 1F 00 00 D6
1EF1:00 00 20 D9 09 A0 A8 20 0C
1EF9:C8 1C A9 00 8D F1 1E AD F4
1F01:34 11 8D 76 12 AD 35 11 79
1F09:8D 77 12 20 C3 14 20 3A 19
1F11:11 20 56 11 4C A9 11 A2 89
1F19:00 8E 39 11 20 24 13 F0 DB
1F21:09 20 50 13 20 78 13 4C 7C
1F29:1D 1F 20 D9 09 20 BC 0C AD
1F31:20 FC 0C A0 00 B9 6F 1C 2C
1F39:F0 07 20 D2 FF C8 4C 36 D4
1F41:1F A2 00 8E 39 11 20 24 13
1F49:13 F0 06 20 AB 1F 4C 47 C9
1F51:1F A2 00 8E 39 11 20 24 23
1F59:13 20 53 11 20 F1 0A C9 4B
1F61:0D F0 13 C9 5E F0 40 C9 62
1F69:30 F0 16 C9 2B F0 20 C9 82
1F71:2D F0 28 4C 5D 1F 20 73 67
1F79:11 20 24 13 F0 D8 4C 5A DB
1F81:1F AE 39 11 A9 00 9D 00 BB
1F89:2C 20 AB 1F 4C 5D 1F AE 12
1F91:39 11 FE 00 2C 20 AB 1F E8
1F99:4C 5D 1F AE 39 11 DE 00 EF
1FA1:2C 20 AB 1F 4C 5D 1F 4C C7
1FA9:65 1E 20 3F 11 AE 39 11 E0
1FB1:BD E0 2B 8D A5 17 A9 12 34
1FB9:20 D2 FF A0 00 A9 A0 20 CE
1FC1:D2 FF C8 CC A5 17 D0 F7 72
1FC9:20 3F 11 A0 00 AE 39 11 52
1FD1:BD 00 2C AA 98 20 09 21 97
1FD9:60 C9 88 F0 0D C9 5E F0 18
1FE1:03 4C F4 11 20 B4 11 4C A6
1FE9:18 1F 4C D5 1C AD 00 2C A6
1FF1:D0 03 4C F3 1E 4C 9D 20 9F
1FF9:A2 00 8E 39 11 20 24 13 53
2001:F0 35 AE 39 11 BD 10 2C 3C
2009:AA BD 00 2C F0 EF BD 20 B3
2011:2C A8 F0 09 A9 20 20 D2 21
2019:FF 88 4C 13 20 20 63 13 91
2021:A4 04 B1 3F C9 A0 B0 02 13
2029:09 40 29 7F 20 D2 FF C8 30
2031:C6 03 D0 EE 4C FE 1F A9 E4
2039:0D 20 D2 FF 60 A0 01 A9 93
2041:2D 20 D2 FF C8 CC 00 2C 20
2049:D0 F5 A9 0D 20 D2 FF 60 22
2051:A9 0D 20 D2 FF A0 00 B9 17
2059:96 20 F0 07 20 D2 FF C8 90
```

```
2061:4C 58 20 AE 95 20 A9 00 4D
2069:20 09 21 8C 94 20 A9 0C 6D
2071:20 D2 FF EE 95 20 60 20 73
2079:3E 20 20 F9 15 AD 34 11 5D
2081:8D 76 12 AD 35 11 8D 77 C3
2089:12 20 F9 1F 20 3E 20 20 66
2091:06 16 60 00 00 20 50 41 C8
2099:47 45 20 00 A0 2D B9 7A 7A
20A1:21 F0 07 20 D2 FF C8 4C 06
20A9:9F 20 20 F5 1D 20 BE 21 2D
20B1:20 78 20 A2 01 8E 95 20 DB
20B9:A2 36 8E 94 20 20 95 12 B2
20C1:20 E1 FF F0 30 20 F9 1F AE
20C9:CE 94 20 F0 0E 20 AC 12 06
20D1:20 D2 12 20 07 17 90 1A EA
20D9:4C C1 20 20 51 20 20 BE C0
20E1:21 20 78 20 20 AC 12 20 C3
20E9:D2 12 20 07 17 90 06 4C DF
20F1:C1 20 20 51 20 20 0A 1E E7
20F9:4C D5 1C 38 A9 FF ED 33 39
2101:2C AA A9 CF ED 34 2C 60 2F
2109:A0 37 84 01 20 CD BD A0 5E
2111:36 84 01 60 A0 00 B9 D0 FE
2119:27 F0 07 20 D2 FF C8 4C 82
2121:17 21 60 A0 50 A9 00 99 10
2129:CF 27 88 D0 FA 60 20 D9 AE
2131:09 A0 00 B9 7A 21 F0 07 FC
2139:20 D2 FF C8 4C 34 21 20 62
2141:71 21 20 15 21 20 71 21 67
2149:A0 00 20 CF FF 99 D0 27 0C
2151:C8 C9 0D D0 F5 88 8C 39 3D
2159:2C F0 12 A9 00 99 D0 27 F9
2161:38 AD 00 2C ED 39 2C 90 2B
2169:C5 4A 8D 3A 2C 4C D5 1C D0
2171:A0 00 A2 04 18 20 F0 FF BB
2179:60 13 11 12 20 20 20 20 D5
2181:20 20 20 20 20 45 4E 54 E8
2189:45 52 20 52 45 50 4F 52 88
2191:54 20 48 45 41 44 49 4E 5F
2199:47 20 20 20 20 20 20 20 6F
21A1:20 20 20 20 0D 00 93 11 A2
21A9:11 50 52 49 4E 54 49 4E 0C
21B1:47 20 52 45 43 4F 52 44 7E
21B9:53 2E 2E 2E 00 AC 3A 2C 2D
21C1:A9 20 20 D2 FF 88 D0 F8 CE
21C9:20 15 21 A9 0D 20 D2 FF AE
21D1:A9 0D 20 D2 FF 60 A0 00 20
21D9:B9 00 22 F0 07 20 D2 FF AA
21E1:C8 4C D9 21 20 F1 0A C9 8F
21E9:59 F0 03 4C AB 09 A9 8B 9A
21F1:8D 00 03 A9 E3 8D 01 03 50
21F9:A0 37 84 01 4C 66 FE 93 88
2201:9C 12 51 55 49 54 2E 2E BD
2209:2E 41 52 45 20 59 4F 55 AD
2211:20 53 55 52 45 3F 20 28 99
2219:59 2F 4E 29 00 4C F6 20 71
2221:AD 00 2C D0 03 4C F3 1E 1E
2229:A0 00 B9 A0 22 F0 07 20 02
2231:D2 FF C8 4C 2B 22 20 F5 D4
2239:1D 20 95 12 20 E1 FF F0 61
2241:DC A2 06 8E B1 22 20 58 F4
2249:22 20 AC 12 20 D2 12 20 ED
2251:07 17 90 C9 4C 3D 22 A2 CB
2259:00 8E 39 11 20 24 13 F0 22
2261:2D AC 39 11 BE 10 2C BD EB
2269:00 2C F0 F0 CE B1 22 20 87
2271:63 13 A4 04 B1 3F C9 A0 BF
2279:B0 02 09 40 29 7F 20 D2 16
2281:FF C8 C6 03 D0 EE A9 0D A3
2289:20 D2 FF 4C 5D 22 AE B1 D9
2291:22 30 0B F0 09 A9 0D 20 8C
2299:D2 FF CA 4C 94 22 60 93 E6
22A1:50 52 49 4E 54 49 4E 47 5C
22A9:20 4C 41 42 45 4C 53 00 5F
22B1:00 00 00 00 00 00 00 00 F5
```

BEFORE TYPING . . .

Before typing in programs, please refer to "How to Type In COMPUTE!'s GAZETTE Programs," elsewhere in this issue.

Power BASIC: Power POKE

Article on page 61.

Program 1: Power POKE—64 Version

```
HE 10 REM COPYRIGHT 1988 COMPU
      TE! PUBLICATIONS, INC. -
       ALL RIGHTS RESERVED
RH 20 PRINT"{CLR}{3 SPACES}COP
      YRIGHT 1988 COMPUTE! PUB
      ., INC."
CA 30 PRINTTAB(11)"ALL RIGHTS
      {SPACE}RESERVED"
XX 40 FORI=679TO728:READA:POKE
      I,A:X=X+A:NEXT
JR 50 IFX<>5022THENPRINT"
      {DOWN}DATA STATEMENT ERR
      OR.":STOP
CF 60 SYS679
MB 70 DATA 169,178,141,8,3,169
      ,2,141,9,3
HQ 80 DATA 96,32,115,0,201,151
      ,240,6,32,121
MM 90 DATA 0,76,231,167,32,115
      ,0,32,36,184
KR 100 DATA 32,121,0,240,242,2
       30,20,208,2,230
CX 110 DATA 21,32,241,183,32,3
       9,184,76,197,2
```

Program 2: Power POKE—128 Version

```
HE 10 REM COPYRIGHT 1988 COMPU
      TE! PUBLICATIONS, INC. -
       ALL RIGHTS RESERVED
AH 20 BANK15:PRINT"{CLR}
      {3 SPACES}COPYRIGHT 1988
       COMPUTE! PUB., INC."
CA 30 PRINTTAB(11)"ALL RIGHTS
      {SPACE}RESERVED"
XP 40 FORI=2816TO2865:READA:PO
      KEI,A:X=X+A:NEXT
FH 50 IFX<>4688THENPRINT"
      {DOWN}DATA STATEMENT ERR
      OR.":STOP
MX 60 SYS2816
KR 70 DATA 169,11,141,8,3,169,
      11,141,9,3
BQ 80 DATA 96,32,128,3,201,151
      ,240,6,32,134
EJ 90 DATA 3,76,243,74,32,128,
      3,32,229,128
RH 100 DATA 32,134,3,240,242,2
       30,22,208,2,230
KR 110 DATA 23,32,9,136,32,232
       ,128,76,30,11
```

Program 3: Power POKE—Plus/4 And 16

```
HE 10 REM COPYRIGHT 1988 COMPU
      TE! PUBLICATIONS, INC. -
       ALL RIGHTS RESERVED
RH 20 PRINT"{CLR}{3 SPACES}COP
      YRIGHT 1988 COMPUTE! PUB
      ., INC."
CA 30 PRINTTAB(11)"ALL RIGHTS
      {SPACE}RESERVED"
SK 40 FORI=819TO868:READA:POKE
      I,A:X=X+A:NEXT
RP 50 IFX<>4627THENPRINT"
      {DOWN}DATA STATEMENT ERR
      OR.":STOP
ED 60 SYS819
RB 70 DATA 169,62,141,8,3,169,
      3,141,9,3
DA 80 DATA 96,32,115,4,201,151
      ,240,6,32,121
MJ 90 DATA 4,76,217,139,32,115
      ,4,32,18,158
RB 100 DATA 32,121,4,240,242,2
       30,20,208,2,230
FB 110 DATA 21,32,216,157,32,2
       1,158,76,81,3
```

Mirrors

See program listing on page 65 before typing in.

```
0801:0B 08 01 00 9E 32 30 36 0D
0809:31 00 00 00 A9 00 8D 20 3A
0811:D0 A0 00 84 FB A2 04 86 F2
0819:FC A9 70 91 FB C8 D0 FB D9
0821:E6 FC CA D0 F6 A9 00 85 2E
0829:FB A2 20 86 FC A0 00 91 48
0831:FB C8 D0 FB E6 FC CA D0 DC
0839:F4 A9 18 8D 18 D0 AD 11 7A
0841:D0 09 20 8D 11 D0 A9 FF F7
0849:8D 0F D4 A9 80 8D 12 D4 4C
0851:8D 18 D4 A9 00 8D 68 0E 78
0859:85 FD 85 FE 8D 56 0E A9 D7
0861:FB 8D 55 0E 20 7B 0B A9 0D
0869:FB 85 FD A9 C1 85 FE 20 75
0871:7B 0B A9 C1 85 FE 8D 56 EC
0879:0E A9 00 85 FD 20 7B 0B C5
0881:A9 00 A9 00 85 FD 8D 55 30
0889:0E 85 FE 20 7B 0B 8D 55 5C
0891:0E 85 FE A0 01 8C 6D 0E 17
0899:A9 FA 8D 55 0E A9 7E 85 DD
08A1:FD AD 6D 0E 85 FE 8D 56 44
08A9:0E 20 7B 0B EE 6D 0E AD DF
08B1:6D 0E C9 61 D0 E7 A0 61 14
08B9:8C 6D 0E A9 7D 8D 55 0E A2
08C1:A9 00 85 FD AD 6D 0E 85 FB
08C9:FE 8D 56 0E 20 7B 0B EE 5C
08D1:6D 0E AD 6D 0E C9 C1 D0 94
08D9:E7 C8 A9 01 A0 00 99 05 92
08E1:0E C8 C0 50 D0 F8 A9 00 06
08E9:8D 74 0E A9 FF 8D 73 0E 65
08F1:AD 1B D4 29 3F 8D 05 0E 15
08F9:AD 1B D4 29 3F 8D 19 0E 45
0901:AD 1B D4 29 3F 8D 2D 0E 76
0909:AD 1B D4 29 3F 8D 41 0E A6
0911:20 72 0B 8D 69 0E 20 72 40
0919:0B 8D 6A 0E 20 72 0B 8D B0
0921:6B 0E 20 72 0B 8D 6C 0E 0D
0929:20 E4 FF C9 00 F0 03 4C 37
0931:F2 0D A9 01 8D 68 0E AC 1C
0939:74 0E C8 C0 10 D0 02 A0 96
0941:00 8C 74 0E B9 05 0E 85 69
0949:FD B9 19 0E 8D 55 0E B9 64
0951:2D 0E 85 FE B9 41 0E 8D 9A
0959:56 0E 20 7B 0B AC 74 0E D7
0961:A9 00 8D 68 0E 38 A9 FB 21
0969:F9 05 0E 8D 6F 0E 8D 55 78
0971:0E 38 A9 FB F9 19 0E 8D 6B
0979:6E 0E 85 FD B9 2D 0E 8D 03
0981:56 0E B9 41 0E 85 FE 20 32
0989:7B 0B AC 74 0E B9 05 0E 68
0991:85 FD B9 19 0E 8D 55 0E 0E
0999:38 A9 C1 F9 2D 0E 8D 71 38
09A1:0E 85 FE 38 A9 C1 F9 41 09
09A9:0E 8D 70 0E 8D 56 0E 20 17
09B1:7B 0B A9 01 8D 68 0E AD 61
09B9:6E 0E 85 FD AD 6F 0E 8D EB
09C1:55 0E AD 70 0E 85 FE AD F0
09C9:71 0E 8D 56 0E 20 7B 0B 22
09D1:A9 00 8D 68 0E AC 73 0E 09
09D9:C8 C0 10 D0 02 A0 00 8C AE
09E1:73 0E B9 05 0E 85 FD B9 F4
09E9:19 0E 8D 55 0E B9 2D 0E D2
09F1:85 FE B9 41 0E 8D 56 0E 33
09F9:20 7B 0B AC 73 0E A9 01 4F
0A01:8D 68 0E 38 A9 FB F9 05 71
0A09:0E 8D 6F 0E 8D 55 0E 38 6C
```

```
0A11:A9 FB F9 19 0E 8D 6E 0E 5B
0A19:85 FD B9 2D 0E 8D 56 0E DA
0A21:B9 41 0E 85 FE 20 7B 0B F6
0A29:AC 73 0E B9 05 0E 85 FD 37
0A31:B9 19 0E 8D 55 0E 38 A9 FF
0A39:C1 F9 2D 0E 8D 71 0E 85 07
0A41:FE 38 A9 C1 F9 41 0E 8D B2
0A49:70 0E 8D 56 0E 20 7B 0B 23
0A51:A9 00 8D 68 0E AD 6E 0E 84
0A59:85 FD AD 6F 0E 8D 55 0E BB
0A61:AD 70 0E 85 FE AD 71 0E 22
0A69:8D 56 0E 20 7B 0B AE 73 76
0A71:0E BD 05 0E 18 6D 69 0E D4
0A79:C9 01 90 04 C9 7E 90 1D 8B
0A81:20 72 0B 18 69 01 8D 72 02
0A89:0E AD 69 0E 30 09 A9 00 17
0A91:38 ED 72 0E 8D 72 0E AD 6C
0A99:72 0E 8D 69 0E BD 05 0E 32
0AA1:18 6D 69 0E 9D 06 0E BD 0A
0AA9:19 0E 18 6D 6A 0E C9 01 C7
0AB1:90 04 C9 7E 90 1D 20 72 DB
0AB9:0B 18 69 01 8D 72 0E AD 96
0AC1:6A 0E 30 09 A9 00 38 ED D0
0AC9:72 0E 8D 72 0E AD 72 0E 8D
0AD1:8D 6A 0E BD 19 0E 18 6D 83
0AD9:6A 0E 9D 1A 0E BD 2D 0E CB
0AE1:18 6D 6B 0E C9 01 90 04 23
0AE9:C9 61 90 1D 20 72 0B 18 18
0AF1:69 01 8D 72 0E AD 6B 0E DF
0AF9:30 09 A9 00 38 ED 72 0E 0A
0B01:8D 72 0E AD 72 0E 8D 6B 69
0B09:0E BD 2D 0E 18 6D 6B 0E 77
0B11:9D 2E 0E BD 41 0E 18 6D FE
0B19:6C 0E C9 01 90 04 C9 61 BB
0B21:90 1D 20 72 0B 18 69 01 7E
0B29:8D 72 0E AD 6C 0E 30 09 44
0B31:A9 00 38 ED 72 0E 8D 72 5B
0B39:0E AD 72 0E 8D 6C 0E BD E8
0B41:41 0E 18 6D 6C 0E 9D 42 6E
0B49:0E A9 10 8D 6D 0E CE 6D 5A
0B51:0E EC 6D 0E D0 18 BD 06 A0
0B59:0E 8D 05 0E BD 1A 0E 8D 5B
0B61:19 0E BD 2E 0E 8D 2D 0E 31
0B69:BD 42 0E 8D 41 0E 4C 29 8D
0B71:09 AD 1B D4 29 03 18 69 17
0B79:01 60 A9 00 8D 64 0E AD 25
0B81:55 0E 38 E5 FD 8D 57 0E 0E
0B89:8D 61 0E A9 00 E9 00 8D 50
0B91:62 0E 10 23 A5 FD 8D 5D 2E
0B99:0E AD 55 0E 85 FD AD 5D 8A
0BA1:0E 8D 55 0E A5 FE 8D 5F 51
0BA9:0E AD 56 0E 85 FE AD 5F C0
0BB1:0E 8D 56 0E 4C 80 0B A5 FD
0BB9:FD 18 69 20 85 FD A9 00 7B
0BC1:69 00 A6 FD A4 FE 20 0D AF
0BC9:0D A9 E6 8D 42 0C 8D C9 AD
0BD1:0C AD 56 0E 38 E5 FE 8D E9
0BD9:58 0E 8D 63 0E B0 14 A9 8C
0BE1:C6 8D 42 0C 8D C9 0C A9 1D
0BE9:00 38 ED 58 0E 8D 58 0E B6
0BF1:8D 63 0E 0E 61 0E 2E 62 4C
0BF9:0E 0E 63 0E 2E 64 0E AD B4
0C01:57 0E CD 58 0E 90 03 4C 8C
0C09:8C 0C A9 01 8D 5A 0E AD 4F
0C11:61 0E 8D 5B 0E 38 ED 63 55
0C19:0E 8D 5D 0E AD 62 0E 8D C8
0C21:5C 0E ED 64 0E 8D 5E 0E 60
0C29:AD 5B 0E 38 ED 58 0E 8D AE
0C31:5F 0E AD 5C 0E E9 00 8D 9D
0C39:60 0E AE 58 0E E8 8E 65 F6
0C41:0E E6 FE AD 60 0E 30 20 90
0C49:A9 01 8D 59 0E E6 FD AD 73
0C51:5F 0E 18 6D 5D 0E 8D 5F 14
0C59:0E AD 60 0E 6D 5E 0E 8D 5F
0C61:60 0E CE 65 0E D0 1E 60 AD
0C69:A9 00 8D 59 0E AD 5F 0E 91
0C71:18 6D 5B 0E 8D 5F 0E AD F0
0C79:60 0E 6D 5C 0E 8D 60 0E 2E
0C81:CE 65 0E F0 E2 20 6F 0D AE
0C89:4C 42 0C A9 01 8D 59 0E 73
0C91:AD 63 0E 8D 5B 0E 38 ED 65
0C99:61 0E 8D 5D 0E AD 64 0E 6B
0CA1:8D 5C 0E ED 62 0E 8D 5E FC
0CA9:0E AD 5B 0E 38 ED 57 0E B6
0CB1:8D 5F 0E AD 5C 0E E9 00 F3
0CB9:8D 60 0E AD 57 0E 8D 65 C0
0CC1:0E E6 FD AD 60 0E 30 29 F9
0CC9:E6 FE A9 01 8D 5A 0E AD F9
0CD1:5F 0E 18 6D 5D 0E 8D 5F 94
0CD9:0E AD 60 0E 6D 5E 0E 8D DF
0CE1:60 0E AD 65 0E D0 01 60 CF
0CE9:CE 65 0E 20 6F 0D 4C C2 91
0CF1:0C A9 00 8D 5A 0E AD 5F 19
0CF9:0E 18 6D 5B 0E 8D 5F 0E F5
0D01:AD 60 0E 6D 5C 0E 8D 60 39
0D09:0E 4C E3 0C 48 8A 29 07 40
0D11:8D 67 0E 8A 29 F8 48 A9 9D
0D19:00 85 FC 98 29 F8 18 2A 45
0D21:26 FC 2A 26 FC 2A 26 FC 0F
0D29:85 FB A6 FC 2A 26 FC 2A B7
0D31:26 FC 65 FB 85 FB 8A 65 A0
0D39:FC 09 20 85 FC 68 65 FB C0
0D41:85 FB 68 65 FC 85 FC 98 11
0D49:29 07 65 FB 85 FB A5 FC 8A
0D51:69 00 85 FC A0 00 AE 67 6A
0D59:0E AD 68 0E D0 08 B1 FB D9
0D61:1D F5 0D 91 FB 60 B1 FB 03
0D69:3D FD 0D 91 FB 60 AE 59 74
0D71:0E AC 5A 0E A5 FD 29 07 68
0D79:8D 67 0E E0 00 F0 13 C9 B7
0D81:00 D0 0B A5 FB 18 69 08 A6
0D89:85 FB 90 02 E6 FC C0 00 44
0D91:F0 43 A5 FE 29 07 AC C9 22
0D99:0C C0 E6 D0 1B C9 00 D0 A4
0DA1:10 E6 FC A5 FB 18 69 39 C3
0DA9:85 FB 90 29 E6 FC 4C D6 C4
0DB1:0D E6 FB F0 F7 4C D6 0D 46
0DB9:C9 07 D0 10 C6 FC A5 FB 07
0DC1:38 E9 39 85 FB B0 0E C6 77
0DC9:FC 4C D6 0D A5 FB 38 E9 98
0DD1:01 85 FB 90 F2 A0 00 AE 1F
0DD9:67 0E AD 68 0E D0 0A A0 CF
0DE1:00 B1 FB 1D F5 0D 91 FB BC
0DE9:60 B1 FB 3D FD 0D 91 FB 37
0DF1:60 4C 18 E5 80 40 20 10 06
0DF9:08 04 02 01 7F BF DF EF 14
0E01:F7 FB FD FE 00 00 00 00 C7
```

BEFORE TYPING . . .

Before typing in programs, please refer to "How to Type In COMPUTE!'s GAZETTE Programs," elsewhere in this issue.

Phantom LIST

Article on page 71.

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JA 30 PRINTTAB(11)"ALL RIGHTS
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JS 40 J=4864:FORB=0TO511:READA
      :POKEJ+B,A:X=X+A:NEXT
JF 50 IFX<>60173THENPRINT"ERRO
      R IN DATA STATEMENTS":ST
      OP
SG 60 PRINT"SYS 4864 TO ACTIVA
      TE...":END
FH 70 DATA104,104,32,125,255,7
      9,78,0,169,21,162,19
DD 80 DATA141,0,3,142,1,3,76,2
      22,20,134,251,173
JP 90 DATA1,2,240,3,76,63,77,1
      73,0,2,201,64
JM 100 DATA208,48,32,232,20,16
       9,15,168,162,8,32,186
PC 110 DATA255,169,0,32,189,25
       5,32,192,255,162,15,32
BS 120 DATA198,255,32,207,255,
       201,13,240,6,32,105,146
AR 130 DATA76,62,19,169,15,32,
       195,255,32,204,255,76
MX 140 DATA222,20,201,81,208,1
       4,32,125,255,79,70,70
RA 150 DATA0,169,63,162,77,76,
       12,19,201,95,240,5
RC 160 DATA166,251,76,63,77,32
       ,125,255,147,17,70,73
BM 170 DATA76,69,32,78,65,77,6
       9,63,32,0,169,0
MF 180 DATA133,208,133,251,133
       ,254,169,0,133,244,32,1
       25
SJ 190 DATA255,175,157,0,169,1
       ,133,244,32,225,255,208
XS 200 DATA8,169,13,32,105,146
       ,76,222,20,32,228,255
XD 210 DATA240,238,201,13,208,
       15,166,251,240,230,32,1
       25
SH 220 DATA255,13,147,17,17,0,
       76,222,19,201,20,208
RC 230 DATA12,166,251,240,211,
       32,105,146,198,251,76,1
       38
QX 240 DATA19,166,251,224,16,1
       76,197,157,0,21,32,105
RK 250 DATA146,230,251,76,138,
       19,32,232,20,165,251,16
       2
GA 260 DATA0,160,21,32,189,255
       ,169,0,162,0,32,104
RH 270 DATA255,169,5,162,8,160
       ,5,32,186,255,32,192
FK 280 DATA255,162,5,32,198,25
       5,32,205,20,32,205,20
GD 290 DATA32,205,20,32,205,20
       ,201,0,240,23,32,205
KD 300 DATA20,133,253,32,205,2
       0,166,253,32,50,142,169
EE 310 DATA32,32,105,146,32,22
       5,255,208,3,76,214,20
FQ 320 DATA165,211,201,1,240,2
       50,32,205,20,201,0,208
RE 330 DATA8,169,13,32,105,146
       ,76,8,20,166,244,208
RK 340 DATA220,201,128,144,216
       ,76,86,20,164,75,41,127
KJ 350 DATA32,12,86,76,36,20,2
       01,254,240,47,201,206
XQ 360 DATA240,69,170,132,75,1
       69,68,160,23,133,37,132
PH 370 DATA36,160,0,202,16,15,
       177,36,72,230,36,208
PH 380 DATA2,230,37,104,16,244
       ,48,239,200,?177,36,48
PM 390 DATA203,32,12,86,208,24
       6,76,36,20,170,200,32
HQ 400 DATA207,255,240,192,132
       ,75,201,2,144,39,201,39
SS 410 DATA176,35,105,126,170,
       160,9,169,70,208,194,17
       0
PE 420 DATA200,32,207,255,240,
       166,132,75,201,2,144,13
HR 430 DATA201,11,176,9,105,12
       6,170,160,201,169,70,20
       8
SH 440 DATA168,224,254,208,3,1
       62,0,44,162,255,24,160
KF 450 DATA0,76,125,20,96,32,2
       07,255,166,144,240,248
QS 460 DATA104,104,169,5,32,19
       5,255,32,204,255,169,0
EG 470 DATA133,208,141,0,2,76,
       55,77,32,69,168,169
DS 480 DATA0,133,144,169,8,32,
       62,227,36,144,48,1
BJ 490 DATA96,104,104,162,5,76
       ,63,77
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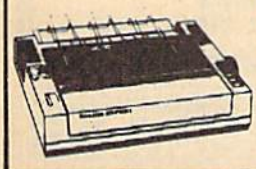

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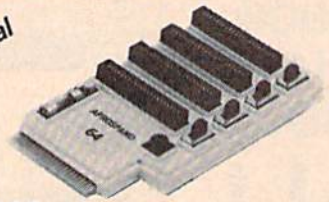

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- Perform numerous DOS functions such as rename a disk, rename a file, scratch or unscratch files, lock or unlock files, create auto-boot and much more!

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How To Type In *COMPUTE!'s Gazette* Programs

Each month, COMPUTE!'s Gazette publishes programs for the Commodore 128, 64, Plus/4, and 16. Each program is clearly marked by title and version. Be sure to type in the correct version for your machine. All 64 programs run on the 128 in 64 mode. Be sure to read the instructions in the corresponding article. This can save time and eliminate any questions which might arise after you begin typing.

We frequently publish two programs designed to make typing easier: The Automatic Proofreader, and MLX, designed for entering machine language programs.

When entering a BASIC program, be especially careful with DATA statements as they are extremely sensitive to errors. A mistyped number in a DATA statement can cause your machine to "lock up" (you'll have no control over the computer). If this happens, the only recourse is to turn your computer off then on, erasing what was in memory. So be sure to *save a program before you run it.* If your computer crashes, you can always reload the program and look for the error.

Special Characters

Most of the programs listed in each issue contain special control characters. To facilitate typing in any programs from the GAZETTE, use the following listing conventions.

The most common type of control characters in our listings appear as words within braces: {DOWN} means to press the cursor down key; {5 SPACES} means to press the space bar five times.

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing another key), the character is underlined. For example, A means hold down the SHIFT key and press A. You may see strange characters on your screen, but that's to be expected. If you find a number followed by an underlined key enclosed in braces (for example, {8 A}), type the key as many times as indicated (in our example, enter eight SHIFTed A's).

If a key is enclosed in special brackets, [ ], hold down the Commodore key (at the lower left corner of the keyboard) and press the indicated character.

Rarely, you'll see a single letter of the alphabet enclosed in braces. This can be entered on the Commodore 64 by pressing the CTRL key while typing the letter in braces. For example, {A} means to press CTRL-A.

The Quote Mode

Although you can move the cursor around the screen with the CRSR keys, often a programmer will want to move the cursor under program control. This is seen in examples such as {LEFT}, and {HOME} in the program listings. The only way the computer can tell the difference between direct and programmed cursor control is *the quote mode.*

Once you press the quote key, you're in quote mode. This mode can be confusing if you mistype a character and cursor left to change it. You'll see a reverse video character (a graphics symbol for cursor left). In this case, you can use the DELete key to back up and edit the line. Type another quote and you're out of quote mode. If things really get confusing, you can exit quote mode simply by pressing RETURN. Then just cursor up to the mistyped line and fix it.

When You Read:	Press:	See:
{CLR}	SHIFT + CLR/HOME	
{HOME}	CLR/HOME	
{UP}	SHIFT + ↑ CRSR ↓	
{DOWN}	↑ CRSR ↓	
{LEFT}	SHIFT + ← CRSR →	
{RIGHT}	← CRSR →	
{RVS}	CTRL + 9	
{OFF}	CTRL + 0	
{BLK}	CTRL + 1	
{WHT}	CTRL + 2	
{RED}	CTRL + 3	
{CYN}	CTRL + 4	

When You Read:	Press:	See:
{PUR}	CTRL + 5	
{GRN}	CTRL + 6	
{BLU}	CTRL + 7	
{YEL}	CTRL + 8	
{ F1 }	f1	
{ F2 }	SHIFT + f1	
{ F3 }	f3	
{ F4 }	SHIFT + f3	
{ F5 }	f5	
{ F6 }	SHIFT + f5	
{ F7 }	f7	
{ F8 }	SHIFT + f7	

When You Read:	Press:	See:
←	←	
↑	SHIFT + ↑	

For Commodore 64 Only

[1]	COMMODORE + 1	
[2]	COMMODORE + 2	
[3]	COMMODORE + 3	
[4]	COMMODORE + 4	
[5]	COMMODORE + 5	
[6]	COMMODORE + 6	
[7]	COMMODORE + 7	
[8]	COMMODORE + 8	

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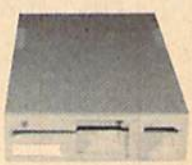

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The Automatic Proofreader

Philip I. Nelson

"The Automatic Proofreader" helps you type in program listings for the 128, 64, Plus/4, and 16 and prevents nearly every kind of typing mistake.

Type in the Proofreader *exactly* as listed. Since the program can't check itself, type carefully to avoid mistakes. Don't omit any lines, even if they contain unfamiliar commands. After finishing, save a copy or two on disk or tape before running it. This is important because the Proofreader erases the BASIC portion of itself when you run it, leaving only the machine language portion in memory.

Next, type RUN and press RETURN. After announcing which computer it's running on, the Proofreader displays the message "Proofreader Active". Now you're ready to type in a BASIC program.

Every time you finish typing a line and press RETURN, the Proofreader displays a two-letter checksum in the upper-left corner of the screen. Compare this result with the two-letter checksum printed to the left of the line in the program listing. If the letters match, it's almost certain the line was typed correctly. If the letters don't match, check for your mistake and correct the line.

The Proofreader ignores spaces not enclosed in quotes, so you can omit or add spaces between keywords and still see a matching checksum. However, since spaces inside quotes are almost always significant, the Proofreader pays attention to them. For example, **10 PRINT"THIS IS BASIC"** will generate a different checksum than **10 PRINT"THIS ISBA SIC"**.

A common typing error is transposition—typing two successive characters in the wrong order, like PIRNT instead of PRINT or 64378 instead of 64738. The Proofreader is sensitive to the *position* of each character within the line and thus catches transposition errors.

The Proofreader does *not* accept keyword abbreviations (for example, ? instead of PRINT). If you prefer to use abbreviations, you can still check the line by LISTing it after typing it in, moving the cursor back to the line, and pressing RETURN. LISTing the line substitutes the full keyword for the abbreviation and allows the Proofreader to work properly. The same technique works for rechecking programs you've already typed in.

If you're using the Proofreader on the Commodore 128, Plus/4, or 16, *do not perform any GRAPHIC commands while the Proofreader is active.* When you perform a command like GRAPHIC 1, the computer moves everything at the start of BASIC program space—including the Proofreader—to another memory area, causing the Proofreader to crash. The same thing happens if you *run* any program with a GRAPHIC command while the Proofreader is in memory.

Though the Proofreader doesn't interfere with other BASIC operations, it's a good idea to disable it before running another program. However, the Proofreader is purposely difficult to dislodge: It's not affected by tape or disk operations, or by pressing RUN/STOP- RESTORE. The simplest way to disable it is to turn the computer off then on. A gentler method is to SYS to the computer's built-in reset routine (SYS 65341 for the 128, 64738 for the 64, and 65526 for the Plus/4 and 16). These reset routines erase any program in memory, so be sure to save the program you're typing in before entering the SYS command.

If you own a Commodore 64, you may already have wondered whether the Proofreader works with other programming utilities like "MetaBASIC." The answer is generally yes, *if you're using a 64 and activate the Proofreader after installing the other utility.* For example, first load and activate MetaBASIC, then load and run the Proofreader.

When using the Proofreader with another utility, you should disable *both* programs before running a BASIC program. While the Proofreader seems unaffected by most utilities, there's no way to promise that it will work with any and every combination of utilities you might want to use. The more utilities activated, the more fragile the system becomes.

The New Automatic Proofreader

```
10 VEC=PEEK(772)+256*PEEK(773)
   :LO=43:HI=44
20 PRINT "AUTOMATIC PROOFREADE
   R FOR ";:IF VEC=42364 THEN
   {SPACE}PRINT "C-64"
30 IF VEC=50556 THEN PRINT "VI
   C-20"
40 IF VEC=35158 THEN GRAPHIC C
   LR:PRINT "PLUS/4 & 16"
50 IF VEC=17165 THEN LO=45:HI=
   46:GRAPHIC CLR:PRINT"128"
60 SA=(PEEK(LO)+256*PEEK(HI))+
   6:ADR=SA
70 FOR J=0 TO 166:READ BYT:POK
   E ADR,BYT:ADR=ADR+1:CHK=CHK
   +BYT:NEXT
80 IF CHK<>20570 THEN PRINT "*
   ERROR* CHECK TYPING IN DATA
    STATEMENTS":END
90 FOR J=1 TO 5:READ RF,LF,HF:
   RS=SA+RF:HB=INT(RS/256):LB=
   RS-(256*HB)
100 CHK=CHK+RF+LF+HF:POKE SA+L
   F,LB:POKE SA+HF,HB:NEXT
110 IF CHK<>22054 THEN PRINT "
   *ERROR* RELOAD PROGRAM AND
   {SPACE}CHECK FINAL LINE":EN
   D
120 POKE SA+149,PEEK(772):POKE
    SA+150,PEEK(773)
130 IF VEC=17165 THEN POKE SA+
   14,22:POKE SA+18,23:POKESA+
   29,224:POKESA+139,224
140 PRINT CHR$(147);CHR$(17);"
   PROOFREADER ACTIVE":SYS SA
150 POKE HI,PEEK(HI)+1:POKE (P
   EEK(LO)+256*PEEK(HI))-1,0:N
   EW
160 DATA 120,169,73,141,4,3,16
   9,3,141,5,3
170 DATA 88,96,165,20,133,167,
   165,21,133,168,169
180 DATA 0,141,0,255,162,31,18
   1,199,157,227,3
190 DATA 202,16,248,169,19,32,
   210,255,169,18,32
200 DATA 210,255,160,0,132,180
   ,132,176,136,230,180
210 DATA 200,185,0,2,240,46,20
   1,34,208,8,72
220 DATA 165,176,73,255,133,17
   6,104,72,201,32,208
230 DATA 7,165,176,208,3,104,2
   08,226,104,166,180
240 DATA 24,165,167,121,0,2,13
   3,167,165,168,105
250 DATA 0,133,168,202,208,239
   ,240,202,165,167,69
260 DATA 168,72,41,15,168,185,
   211,3,32,210,255
270 DATA 104,74,74,74,74,168,1
   85,211,3,32,210
280 DATA 255,162,31,189,227,3,
   149,199,202,16,248
290 DATA 169,146,32,210,255,76
   ,86,137,65,66,67
300 DATA 68,69,70,71,72,74,75,
   77,80,81,82,83,88
310 DATA 13,2,7,167,31,32,151,
   116,117,151,128,129,167,136
   ,137
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MLX Machine Language Entry Program For Commodore 64 and 128

Ottis R. Cowper

"MLX" is a labor-saving utility that allows almost fail-safe entry of machine language programs. Included are versions for the Commodore 64 and 128.

Type in and save some copies of whichever version of MLX is appropriate for your computer (you'll want to use it to enter future ML programs from COMPUTE!'s GAZETTE). Program 1 is for the Commodore 64, and Program 2 is for the 128 (128 MLX can also be used to enter Commodore 64 ML programs for use in 64 mode). When you're ready to enter an ML program, load and run MLX. It asks you for a starting address and an ending address. These addresses appear in the article accompanying the MLX-format program listing you're typing.

If you're unfamiliar with machine language, the addresses (and all other values you enter in MLX) may appear strange. Instead of the usual decimal numbers you're accustomed to, these numbers are in *hexadecimal*—a base 16 numbering system commonly used by ML programmers. Hexadecimal—hex for short—includes the numerals 0–9 and the letters A–F. But don't worry—even if you know nothing about ML or hex, you should have no trouble using MLX.

After you enter the starting and ending addresses, you'll be offered the option of clearing the workspace. Choose this option if you're starting to enter a new listing. If you're continuing a listing that's partially typed from a previous session, don't choose this option.

A functions menu will appear. The first option in the menu is ENTER DATA. If you're just starting to type in a program, pick this. Press the E key, and type the first number in the first line of the program listing. If you've already typed in part of a program, type the line number where you left off typing at the end of the previous session (be sure to load the partially completed program before you resume entry). In any case, make sure the address you enter corresponds to the address of a line in the listing you are entering. Otherwise, you'll be unable to enter the data correctly. If you pressed E by mistake, you can return to the command menu by pressing RETURN alone when asked for the address. (You can get back to the menu from most options by pressing RETURN with no other input.)

Entering A Listing

Once you're in Enter mode, MLX prints the address for each program line for you. You then type in all nine numbers on that line, beginning with the first two-digit number after the colon (:). Each line represents eight data bytes and a checksum. Although an MLX-format listing appears similar to the "hex dump" listings from a machine language monitor program, the extra checksum number on the end allows MLX to check your typing. (Commodore 128 users *can* enter the data from an MLX listing using the built-in monitor if the rightmost column of data is omitted, but we recommend against it. It's much easier to let MLX do the proofreading and error checking for you.)

When you enter a line, MLX recalculates the checksum from the eight bytes and the address and compares this value to the number from the ninth column. If the values match, you'll hear a bell tone, the data will be added to the workspace area, and the prompt for the next line of data will appear. But if MLX detects a typing error, you'll hear a low buzz and see an error message. The line will then be redisplayed for editing.

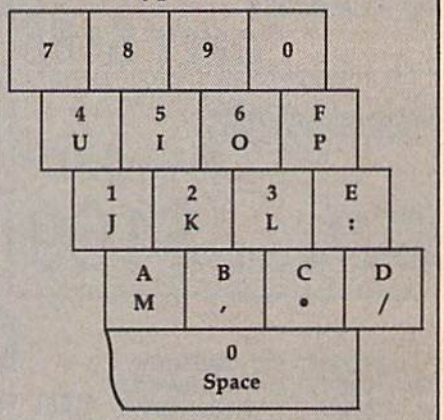
Invalid Characters Banned

Only a few keys are active while you're entering data, so you may have to unlearn some habits. You *do not* type spaces between the columns; MLX automatically inserts these for you. You *do not* press RETURN after typing the last number in a line; MLX automatically enters and checks the line after you type the last digit.

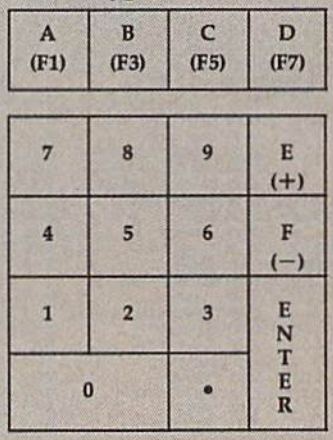
Only the numerals 0–9 and the letters A–F can be typed in. If you press any other key (with some exceptions noted below), you'll hear a warning buzz. To simplify typing, 128 MLX redefines the function keys and + and − keys on the numeric keypad so that you can enter data one-handed. (The 64 version incorporates the keypad modification from the March 1986 "Bug-Swatter" column, lines 485–487.) In either case, the keypad is active only while entering data. Addresses must be entered with the normal letter and number keys. The figures above show the keypad configurations for each version.

MLX checks for transposed characters. If you're supposed to type in A0 and instead enter 0A, MLX will catch your mistake. There is one error that can slip past MLX: Because of the checksum formula used, MLX won't notice if you accidentally type FF in place of 00, and vice versa. And there's a very slim chance that you could garble a line and still end up with a combination of characters that adds up to the proper checksum. However, these mistakes should not occur if you take reasonable care while entering data.

64 MLX Keypad



128 MLX Keypad



Editing Features

To correct typing mistakes before finishing a line, use the INST/DEL key to delete the character to the left of the cursor. (The cursor-left key also deletes.) If you mess up a line really badly, press CLR/HOME to start the line over. The RETURN key is also active, but only before any data is typed on a line. Pressing RETURN at this point returns you to the command menu. After you type a character of data, MLX disables RETURN until the cursor returns to the start of a line. Remember, you can press CLR/HOME to quickly get to a line

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number prompt.

More editing features are available when correcting lines in which MLX has detected an error. To make corrections in a line that MLX has redisplayed for editing, compare the line on the screen with the one printed in the listing, then move the cursor to the mistake and type the correct key. The cursor left and right keys provide the normal cursor controls. (The INST/DEL key now works as an alternative cursor-left key.) You cannot move left beyond the first character in the line. If you try to move beyond the rightmost character, you'll reenter the line. During editing, RETURN is active; pressing it tells MLX to recheck the line. You can press the CLR/HOME key to clear the entire line if you want to start from scratch, or if you want to get to a line number prompt to use RETURN to get back to the menu.

Display Data

The second menu choice, DISPLAY DATA, examines memory and shows the contents in the same format as the program listing (including the checksum). When you press D, MLX asks you for a starting address. Be sure that the starting address you give corresponds to a line number in the listing. Otherwise, the checksum display will be meaningless. MLX displays program lines until it reaches the end of the program, at which point the menu is redisplayed. You can pause the display by pressing the space bar. (MLX finishes printing the current line before halting.) Press space again to restart the display. To break out of the display and get back to the menu before the ending address is reached, press RETURN.

Other Menu Options

Two more menu selections let you save programs and load them back into the computer. These are SAVE FILE and LOAD FILE; their operation is quite straightforward. When you press S or L, MLX asks you for the filename. You'll then be asked to press either D or T to select disk or tape.

You'll notice the disk drive starting and stopping several times during a load or save (save only for the 128 version). Don't panic; this is normal behavior. MLX opens and reads from or writes to the file instead of using the usual LOAD and SAVE commands (128 MLX makes use of BLOAD). Disk users should also note that the drive prefix 0: is automatically added to the filename (line 750 in 64 MLX), so this should *not* be included when entering the name. This also precludes the use of @ for Save-with-Replace, so remember to give each version you save a different name. The 128 version makes up for this by giving you the option of scratching the existing file if you want to reuse a filename.

Remember that MLX saves the entire workspace area from the starting address to the ending address, so the save or load may take longer than you might expect if you've entered only a small amount of data from a long listing. When saving a partially completed listing, make sure to note the address where you stopped typing so you'll know where to resume entry when you reload.

MLX reports the standard disk or tape error messages if any problems are detected during the save or load. (Tape users should bear in mind that Commodore computers are never able to detect errors during a save to tape.) MLX also has three special load error messages: INCORRECT STARTING ADDRESS, which means the file you're trying to load does not have the starting address you specified when you ran MLX; LOAD ENDED AT *address*, which means the file you're trying to load ends before the ending address you specified when you started MLX; and TRUNCATED AT ENDING ADDRESS, which means the file you're trying to load extends beyond the ending address you specified when you started MLX. If you see one of these messages and feel certain that you've loaded the right file, exit and rerun MLX, being careful to enter the correct starting and ending addresses.

The 128 version also has a CATALOG DISK option so you can view the contents of the disk directory before saving or loading.

The QUIT menu option has the obvious effect—it stops MLX and enters BASIC. The RUN/STOP key is disabled, so the Q option lets you exit the program without turning off the computer. (Of course, RUN/STOP-RESTORE also gets you out.) You'll be asked for verification; press Y to exit to BASIC, or any other key to return to the menu. After quitting, you can type RUN again and reenter MLX without losing your data, as long as you don't use the clear workspace option.

The Finished Product

When you've finished typing all the data for an ML program and saved your work, you're ready to see the results. The instructions for loading and using the finished product vary from program to program. Some ML programs are designed to be loaded and run like BASIC programs, so all you need to type is LOAD *"filename"*,8 for disk (DLOAD *"filename"* on the 128) or LOAD *"filename"* for tape, and then RUN. Such programs will usually have a starting address of 0801 for the 64 or 1C01 for the 128. Other programs must be reloaded to specific addresses with a command such as LOAD *"filename"*,8,1 for disk (BLOAD *"filename"* on the 128) or LOAD *"filename"*,1,1 for tape, then started with a SYS to a particular memory address. On the Commodore 64, the most common starting address for such programs is 49152, which corresponds to MLX address C000. In either case, you should always refer to the article which accompanies the ML listing for information on loading and running the program.

An Ounce Of Prevention

By the time you finish typing in the data for a long ML program, you may have several hours invested in the project. Don't take chances—use our "Automatic Proofreader" to type the new MLX, and then test your copy *thoroughly* before first using it to enter any significant amount of data. Make sure all the menu options work as they should. Enter fragments of the program starting at several different addresses, then use the Display option to verify that the data has been entered correctly. And be sure to test the Save and Load options several times to ensure that you can recall your work from disk or tape. Don't let a simple typing error in the new MLX cost you several nights of hard work.

Program 1: MLX For Commodore 64

```
SS 10 REM VERSION 1.1: LINES 8
      30,950 MODIFIED, LINES 4
      85-487 ADDED
EK 100 POKE 56,50:CLR:DIM IN$,
      I,J,A,B,A$,B$,A(7),N$
DM 110 C4=48:C6=16:C7=7:Z2=2:Z
      4=254:Z5=255:Z6=256:Z7=
      127
CJ 120 FA=PEEK(45)+Z6*PEEK(46)
      :BS=PEEK(55)+Z6*PEEK(56
      ):H$="0123456789ABCDEF"
SB 130 R$=CHR$(13):L$="{LEFT}"
      :S$=" ":D$=CHR$(20):Z$=
      CHR$(0):T$="{13 RIGHT}"
CQ 140 SD=54272:FOR I=SD TO SD
      +23:POKE I,0:NEXT:POKE
      {SPACE}SD+24,15:POKE 78
      8,52
FC 150 PRINT"{CLR}"CHR$(142)CH
      R$(8):POKE 53280,15:POK
      E 53281,15
EJ 160 PRINT T$" {RED}{RVS}
      {2 SPACES}§8 @§
      {2 SPACES}"SPC(28)"
      {2 SPACES}{OFF}{BLU} ML
      X II {RED}{RVS}
      {2 SPACES}"SPC(28)"
      {12 SPACES}{BLU}"
FR 170 PRINT"{3 DOWN}
      {3 SPACES}COMPUTE!'S MA
      CHINE LANGUAGE EDITOR
      {3 DOWN}"
JB 180 PRINT"{BLK}STARTING ADD
```

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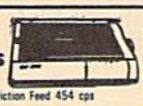

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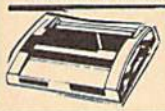

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```
)OR(AD>49151 AND AD<53
248)THEN GOSUB1080:F=0
:RETURN
HC 1050 GOSUB1060:PRINT"{RVS}
{SPACE}INVALID ADDRESS
{DOWN}{BLK}":F=1:RETU
RN
AR 1060 POKE SD+5,31:POKE SD+6
,208:POKE SD,240:POKE
{SPACE}SD+1,4:POKE SD+
4,33
DX 1070 FOR S=1 TO 100:NEXT:GO
TO1090
PF 1080 POKE SD+5,8:POKE SD+6,
240:POKE SD,0:POKE SD+
1,90:POKE SD+4,17
AC 1090 FOR S=1 TO 100:NEXT:PO
KE SD+4,0:POKE SD,0:PO
KE SD+1,0:RETURN
```

Program 2: MLX For Commodore 128

```
AE 100 TRAP 960:POKE 4627,128:
DIM NL$,A(7)
XP 110 Z2=2:Z4=254:Z5=255:Z6=2
56:Z7=127:BS=256*PEEK(4
627):EA=65280
FB 120 BE$=CHR$(7):RT$=CHR$(13
):DL$=CHR$(20):SP$=CHR$
(32):LF$=CHR$(157)
KE 130 DEF FNHB(A)=INT(A/256):
DEF FNLB(A)=A-FNHB(A)*2
56:DEF FNAD(A)=PEEK(A)+
256*PEEK(A+1)
JB 140 KEY 1,"A":KEY 3,"B":KEY
5,"C":KEY 7,"D":VOL 15
:IF RGR(0)=5 THEN FAST
FJ 150 PRINT"{CLR}"CHR$(142);C
HR$(8):COLOR 0,15:COLOR
4,15:COLOR 6,15
GQ 160 PRINT TAB(12)"{RED}
{RVS}{2 SPACES}[9 @]
{2 SPACES}"RT$;TAB(12)"
{RVS}{2 SPACES}{OFF}
{BLU} 128 MLX {RED}
{RVS}{2 SPACES}"RT$;TAB
(12)"{RVS}{13 SPACES}
{BLU}"
FE 170 PRINT"{2 DOWN}
{3 SPACES}COMPUTE!'S MA
CHINE LANGUAGE EDITOR
{2 DOWN}"
DK 180 PRINT"{BLK}STARTING ADD
RESS[4]";:GOSUB 260:IF
{SPACE}AD THEN SA=AD:EL
SE 180
FH 190 PRINT"{BLK}{2 SPACES}EN
DING ADDRESS[4]";:GOSUB
260:IF AD THEN EA=AD:E
LSE 190
MF 200 PRINT"{DOWN}{BLK}CLEAR
{SPACE}WORKSPACE [Y/N]?
[4]":GETKEY A$:IF A$<>"
Y" THEN 220
QH 210 PRINT"{DOWN}{BLU}WORKIN
G...";:BANK 0:FOR A=BS
{SPACE}TO BS+(EA-SA)+7:
POKE A,0:NEXT A:PRINT"D
ONE"
DC 220 PRINT TAB(10)"{DOWN}
{BLK}{RVS} MLX COMMAND
{SPACE}MENU [4]{DOWN}":
PRINT TAB(13)"{RVS}E
{OFF}NTER DATA"RT$;TAB(
13)"{RVS}D{OFF}ISPLAY D
ATA"RT$;TAB(13)"{RVS}L
{OFF}OAD FILE"
HB 230 PRINT TAB(13)"{RVS}S
{OFF}AVE FILE"RT$;TAB(1
3)"{RVS}C{OFF}ATALOG DI
SK"RT$;TAB(13)"{RVS}Q
{OFF}UIT{DOWN}{BLK}"
AP 240 GETKEY A$:A=INSTR("EDLS
CQ",A$):ON A GOTO 340,5
50,640,650,930,940:GOSU
B 950:GOTO 240
SX 250 PRINT"STARTING AT";:GOS
UB 260:IF(AD<>0)OR(A$=N
L$)THEN RETURN:ELSE 250
BG 260 A$=NL$:INPUT A$:IF LEN(
A$)=4 THEN AD=DEC(A$)
PP 270 IF AD=0 THEN BEGIN:IF A
$<>NL$ THEN 300:ELSE RE
TURN:BEND
MA 280 IF AD<SA OR AD>EA THEN
{SPACE}300
PM 290 IF AD>511 AND AD<65280
{SPACE}THEN PRINT BE$;:
RETURN
SQ 300 GOSUB 950:PRINT"{RVS} I
NVALID ADDRESS {DOWN}
{BLK}":AD=0:RETURN
RD 310 CK=FNHB(AD):CK=AD-Z4*CK
+Z5*(CK>Z7):GOTO 330
DD 320 CK=CK*Z2+Z5*(CK>Z7)+A
AH 330 CK=CK+Z5*(CK>Z5):RETURN
QD 340 PRINT BE$;"{RVS} ENTER
{SPACE}DATA ":GOSUB 250
:IF A$=NL$ THEN 220
JA 350 BANK 0:PRINT:F=0:OPEN 3
,3
BR 360 GOSUB 310:PRINT HEX$(AD
)+":";:IF F THEN PRINT
{SPACE}L$:PRINT"{UP}
{5 RIGHT}";
QA 370 FOR I=0 TO 24 STEP 3:B$
=SP$:FOR J=1 TO 2:IF F
{SPACE}THEN B$=MID$(L$,
I+J,1)
PS 380 PRINT"{RVS}"B$+LF$;:IF
{SPACE}I<24 THEN PRINT"
{OFF}";
RC 390 GETKEY A$:IF (A$>"/" AN
D A$<":") OR(A$>"@" AND
A$<"G") THEN 470
AC 400 IF A$="+" THEN A$="E":G
OTO 470
QB 410 IF A$="-" THEN A$="F":G
OTO 470
FB 420 IF A$=RT$ AND ((I=0) AN
D (J=1) OR F) THEN PRIN
T B$;:J=2:NEXT:I=24:GOT
O 480
RD 430 IF A$="{HOME}" THEN PRI
NT B$:J=2:NEXT:I=24:NEX
T:F=0:GOTO 360
XB 440 IF (A$="{RIGHT}") AND F
THEN PRINT B$+LF$;:GOT
O 470
JP 450 IF A$<>LF$ AND A$<>DL$
{SPACE}OR ((I=0) AND (J
=1)) THEN GOSUB 950:GOT
O 390
PS 460 A$=LF$+SP$+LF$:PRINT B$
+LF$;:J=2-J:IF J THEN P
RINT LF$;:I=I-3
GB 470 PRINT A$;:NEXT J:PRINT
{SPACE}SP$;
HA 480 NEXT I:PRINT:PRINT"{UP}
{5 RIGHT}";:L$="
{27 SPACES}"
DP 490 FOR I=1 TO 25 STEP 3:GE
T#3,A$,B$:IF A$=SP$ THE
N I=25:NEXT:CLOSE 3:GOT
O 220
BA 500 A$=A$+B$:A=DEC(A$):MID$
(L$,I,2)=A$:IF I<25 THE
N GOSUB 320:A(I/3)=A:GE
T#3,A$
AR 510 NEXT I:IF A<>CK THEN GO
SUB 950:PRINT:PRINT"
{RVS} ERROR: REENTER LI
NE ":F=1:GOTO 360
DX 520 PRINT BE$:B=BS+AD-SA:FO
R I=0 TO 7:POKE B+I,A(I
):NEXT I
XB 530 F=0:AD=AD+8:IF AD<=EA T
HEN 360
CA 540 CLOSE 3:PRINT"{DOWN}
{BLU}** END OF ENTRY **
{BLK}{2 DOWN}":GOTO 650
MC 550 PRINT BE$;"{CLR}{DOWN}
{RVS} DISPLAY DATA ":GO
SUB 250:IF A$=NL$ THEN
{SPACE}220
JF 560 BANK 0:PRINT"{DOWN}
{BLU}PRESS: {RVS}SPACE
{OFF} TO PAUSE, {RVS}RE
TURN{OFF} TO BREAK[4]
{DOWN}"
XA 570 PRINT HEX$(AD)+":";:GOS
UB 310:B=BS+AD-SA
DJ 580 FOR I=B TO B+7:A=PEEK(I
):PRINT RIGHT$(HEX$(A),
2);SP$;:GOSUB 320:NEXT
{SPACE}I
XB 590 PRINT"{RVS}";RIGHT$(HEX
$(CK),2)
GR 600 F=1:AD=AD+8:IF AD>EA TH
EN PRINT"{BLU}** END OF
DATA **":GOTO 220
EB 610 GET A$:IF A$=RT$ THEN P
RINT BE$:GOTO 220
QK 620 IF A$=SP$ THEN F=F+1:PR
INT BE$;
XS 630 ON F GOTO 570,610,570
RF 640 PRINT BE$"{DOWN}{RVS} L
OAD DATA ":OP=1:GOTO 66
0
BP 650 PRINT BE$"{DOWN}{RVS} S
AVE FILE ":OP=0
DM 660 F=0:F$=NL$:INPUT"FILENA
ME[4]";F$:IF F$=NL$ THE
N 220
RF 670 PRINT"{DOWN}{BLK}{RVS}T
{OFF}APE OR {RVS}D{OFF}
ISK: [4]";
SQ 680 GETKEY A$:IF A$="T" THE
N 850:ELSE IF A$<>"D" T
HEN 680
SP 690 PRINT"DISK{DOWN}":IF OP
THEN 760
EG 700 DOPEN#1,(F$+",P"),W:IF
{SPACE}DS THEN A$=DS$:G
OTO 740
JH 710 BANK 0:POKE BS-2,FNLB(S
A):POKE BS-1,FNHB(SA):P
RINT"SAVING ";F$:PRINT
MC 720 FOR A=BS-2 TO BS+EA-SA:
PRINT#1,CHR$(PEEK(A));:
IF ST THEN A$="DISK WRI
TE ERROR":GOTO 750
GC 730 NEXT A:CLOSE 1:PRINT"
{BLU}** SAVE COMPLETED
{SPACE}WITHOUT ERRORS *
*":GOTO 220
RA 740 IF DS=63 THEN BEGIN:CLO
SE 1:INPUT"{BLK}REPLACE
EXISTING FILE [Y/N][4]
";A$:IF A$="Y" THEN SCR
ATCH(F$):PRINT:GOTO 700
:ELSE PRINT"{BLK}":GOTO
660:BEND
GA 750 CLOSE 1:GOSUB 950:PRINT
"{BLK}{RVS} ERROR DURIN
G SAVE: [4]":PRINT A$:G
OTO 220
FD 760 DOPEN#1,(F$+",P"):IF DS
THEN A$=DS$:F=4:CLOSE
{SPACE}1:GOTO 790
```

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```
PX 770 GET#1,A$,B$:CLOSE 1:AD=
       ASC(A$)+256*ASC(B$):IF
       [SPACE]AD<>SA THEN F=1:
       GOTO 790
KB 780 PRINT"LOADING ";F$:PRIN
       T:BLOAD(F$),B0,P(BS):AD
       =SA+FNAD(174)-BS-1:F=-2
       *(AD<EA)-3*(AD>EA)
RQ 790 IF F THEN 800:ELSE PRIN
       T"{BLU}** LOAD COMPLETE
       D WITHOUT ERRORS **":GO
       TO 220
ER 800 GOSUB 950:PRINT"{BLK}
       {RVS} ERROR DURING LOAD
       : £43":ON F GOSUB 810,8
       20,830,840:GOTO220
QJ 810 PRINT"INCORRECT STARTIN
       G ADDRESS (";HEX$(AD);"
       )":RETURN
DP 820 PRINT"LOAD ENDED AT ";H
       EX$(AD):RETURN
EB 830 PRINT"TRUNCATED AT ENDI
       NG ADDRESS ("HEX$(EA)")
       ":RETURN
FP 840 PRINT"DISK ERROR ";A$:R
       ETURN
KS 850 PRINT"TAPE":AD=POINTER(
       F$):BANK 1:A=PEEK(AD):A
       L=PEEK(AD+1):AH=PEEK(AD
       +2)
XX 860 BANK 15:SYS DEC("FF68")
       ,0,1:SYS DEC("FFBA"),1,
       1,0:SYS DEC("FFBD"),A,A
       L,AH:SYS DEC("FF90"),12
       8:IF OP THEN 890
FG 870 PRINT:A=SA:B=EA+1:GOSUB
        920:SYS DEC("E919"),3:
       PRINT"SAVING ";F$
AB 880 A=BS:B=BS+(EA-SA)+1:GOS
       UB 920:SYS DEC("EA18"):
       PRINT"{DOWN}{BLU}** TAP
       E SAVE COMPLETED **":GO
       TO 220
CP 890 SYS DEC("E99A"):PRINT:I
       F PEEK(2816)=5 THEN GOS
       UB 950:PRINT"{DOWN}
       {BLK}{RVS} FILE NOT FOU
       ND ":GOTO 220
GQ 900 PRINT"LOADING ...{DOWN}
       ":AD=FNAD(2817):IF AD<>
       SA THEN F=1:GOTO 800:EL
       SE AD=FNAD(2819)-1:F=-2
       *(AD<EA)-3*(AD>EA)
JD 910 A=BS:B=BS+(EA-SA)+1:GOS
       UB 920:SYS DEC("E9FB"):
       IF ST>0 THEN 800:ELSE 7
       90
XB 920 POKE193,FNLB(A):POKE194
       ,FNHB(A):POKE 174,FNLB(
       B):POKE 175,FNHB(B):RET
       URN
CP 930 CATALOG:PRINT"{DOWN}
       {BLU}** PRESS ANY KEY F
       OR MENU **":GETKEY A$:G
       OTO 220
MM 940 PRINT BE$"{RVS} QUIT
       £43";RT$;"ARE YOU SURE
       [SPACE][Y/N]?":GETKEY A
       $:IF A$<>"Y" THEN 220:E
       LSE PRINT"{CLR}":BANK 1
       5:END
JE 950 SOUND 1,500,10:RETURN
AF 960 IF ER=14 AND EL=260 THE
       N RESUME 300
MK 970 IF ER=14 AND EL=500 THE
       N RESUME NEXT
KJ 980 IF ER=4 AND EL=780 THEN
        F=4:A$=DS$:RESUME 800
DQ 990 IF ER=30 THEN RESUME:EL
       SE PRINT ERR$(ER);" ERR
       OR IN LINE";EL
```


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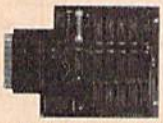

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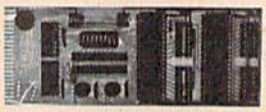

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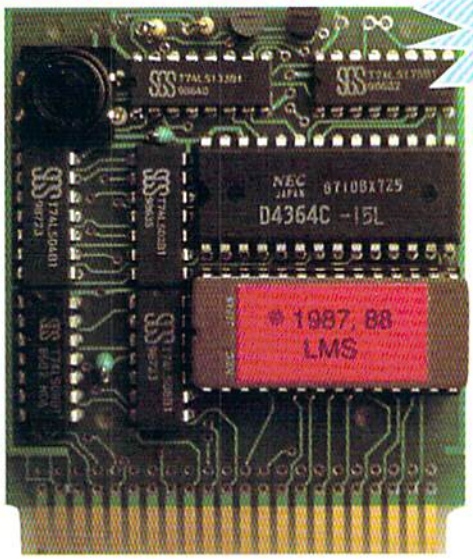

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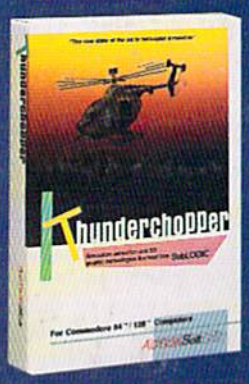

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Colonel Jack provided the strategy and tactics for ThunderChopper

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